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MOTHER LODE '92
FIELD CONFERENCE

August 15 to 20, 1992

GUIDEBOOK VOLUME I
Text

Conducted by

BUREAU OF LAND MANAGEMENT

Gregg Wilkerson
Editor

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PREFACE

The Mother Lode 92 field conference is sponsored by the Bureau of Land Management. It was conceived and conducted by personnel from the Bakersfield District and the Folsom Resource Area Offices. This conference seeks to bring together earth scientists, historians and regulatory personnel to provide information to the public about the geology, history and mine permitting procedures along the Mother Lode Gold Belt.

The Bureau of Land Management is committed to public education and is providing this field conference as a service to public land users. It is part of an outreach program started in 1991 to have monthly public earth science field trips within the Bakersfield District.

This field conference would not be possible without the efforts of several dozen volunteers. This project has become a community effort and we look forward to future conferences of this type in 1993.

We appreciate particularly the volunteer efforts of:

Dana Brown
Cotati, California

David Lawler
Principle
Lawler and Associates Applied Geoscience
Berkeley, California

Far West Geoscience Foundation
David Lawler, Executive Director
Berkeley, California

Shirley Mitchell
California State Mining and Mineral Museum
Mariposa, California

Steve Hanson
West Point, California

This is the first trip BLM has conducted for which teachers may receive college credit. Up to 5 quarter units are available through the Extended Studies and Regional Programs Department of California State University at Bakersfield. Course number ED-X992.546 costs $25.00 per unit.

For more information about BLM earth science field trips contact Dr. Gregg Wilkerson at 805-861-4210 or write BLM, 800 Truxtun Room 302, Bakersfield, CA 93301.

CSUB

Extended Studies and Regional Programs
California State University, Bakersfield
9001 Stockdale Highway
Bakersfield, California 93311-1099

805/664-2441

Plus

Course Title: **Mother Load Gold Belt**

Instructor: **Dr. Gregg Wilkerson**

Course Number: **ED X992.546**

Units: **1.0-5.0 variable quarter units teacher in-service**

Cost: **$25 per unit**
Checks payable to CSUB

Note: It will not be necessary to get a new course number each time you run this course; however, teachers will only get credit for this course number once. Also, check on the cost. It is likely that the per unit fee will increase next year (probably on June 1).

Please return all checks attached to the completed registration form to CSUB-Extended Studies for processing immediately. A course list will be prepared and sent to you. It is important to return grades promptly so that the teachers receive credit toward their pay increases.

If you have questions or need more registration forms, call Sharon S. Goldsmith, Program Coordinator-Extended Studies at 805-664-2444.

INTRODUCTION

This field guide follows, with minor modifications, California Division of Mines and Geology Bulletin 141 which was published in 1949. Incorporated for that portion of the trip from Mariposa to Placerville is information provided by Landefeld and Snow in Yosemite and the Mother Lode Gold Belt, American Association of Petroleum Geologists Book GB68, 1991. In this guidebook sections that are adapted from the 1949 field guide are noted by (49). Those sections that are adapted from the 1991 guide are noted by (91). All mine production values are from the 1941 guide and are not adjusted for inflation or changes since then in the price of gold.

California State Highway 49, variously know as the Mother Lode Highway or the Golden Highway, traverses over 270 miles of the Sierra Nevada, beginning at Mariposa on the South and ending at Sattley on the north. It passes through nine counties, each of which represents an important part of the sierran Gold Belt (49).

This entire region has come to be known generally as the Mother Lode country, but more technically speaking, the Mother Lode is a belt of gold-bearing quartz veins which appears to start at Mariposa and to terminate at Georgetown in Placer County. It forms a more or less continuous belt of quartz veins that occupy a fault zone approximately one mile wide and 120 airline miles long. The 10-mile segment of this belt between Jackson and Plymouth is its richest section and was the source of one-half the gold produced in the entire 120-mile extent, which has amounted to a quarter of a billion dollars. It is noteworthy that this 10-mile segment lies at the bend in the belt where its trend changes form northwest to nearly due north. The Melones fault structure (Clark, 1964, 1970) with which the Mother Lode quartz veins are associated may possibly extend 50 miles farther northward to Downieville through Quincy. Highway 49 leaves the Mother Lode at Placerville and swings 10-15 miles to the west, traversing the even more productive Grass Valley-Nevada City district and other gold-bearing areas of the northern Sierra Nevada (49).

The veins range from great white quartz masses 150 feet wide, down to stringers less than the thickness of one's little finger. The thickness of a vein is no criterion as to its potential value. Rich pocket mines such as those of Jackass Hill were found largely in narrow veinlets, whereas the massive silica-carbonate rock of the Penon Blanco is practically barren of gold (49).

Mining methods and techniques developed in the California gold belt have spread to the far corners of the earth and have become standard practice everywhere. Many famous technicians and financiers had their training in the Mother Lode Country before attaining even greater distinction and achievement in other fields. Bret Harte and Mark Twain owe much of their reputation to the gold

country, and through their stories the romance of the region has become familiar to all the world (49).

Although so much has been written of the history, romance, and folklore of the Sierra Gold Belt, little of general geologic interest has been published for the use of the traveler. The following notes on geology along highway 49 attempt to correlate the geologic, mining, historic, scenic, and cultural features encountered as one travels north along the route from Mariposa to Yuba Pass and Sierra Valley (49).

The geologic maps for the 49 guide are reproduced in this guidebook. They form a continuous strip through the Sierran Gold Belt and cover an area a few miles wide on either side of Highway 49. In the preparation of the maps and the descriptions, material was assembled from various sources of information, published and unpublished, supplemented by field notes. A map bibliography is included in this field guide.

DAY #1: MARIPOSA TO JAMESTOWN

MARIPOSA TO COULTERVILLE: GEOLOGIC MAP #1

MARIPOSA

A point a few miles south of the town of Mariposa marks the southern terminus of Highway 49. Mariposa, the county seat of Mariposa County, is on the tourist route to Yosemite Valley, and its fine old County Courthouse, a white frame structure erected in 1854 has been in use continuously since that date. The town lies at an elevation slightly above 2000 feet in a northwesterly trending valley bordered to east and west by ridges of moderate height. Vegetation in this region is sparse and is composed largely of digger pines, small oak trees, and patches of chaparral. There are a few small stands of yellow pine on protected north slopes southwest of Mariposa. Early day logging operation remove much of the timber in this region (49).

COUNTY FAIR GROUNDS: Mariposa Mine

A mile south of Mariposa, in the vicinity of the County Fair Grounds, are the dumps and partly caved workings of the Mariposa mine, which was discovered in 1849 by Kit Carson and two associates. As early as July 1849 , Palmer, cook, and Company were running a stamp mill on ore from the Mariposa mine. In 1859 John C. Fremont wrested the title to the mine from its original owners when accorded title to the Las Mariposas grant of 44,000 acres. Mines of the Las Mariposas grant also included the Pine Tree, Josephine, Princeton, and many minor workings such as the Penon Blanco claim. The latter is one of the longest claims on record, titles having been recorded before length limitations on mining claims became law. The Mariposa mine had its heyday between 1900 and 1915, 1901 being the peak year. Estimated total production for the mine is $2,193,205. Workings reached a depth of about 1550 feet along a 60° to 70° incline or about 1350 feet vertically. The veins lie in meta-augite andesite of the Penon Blanco formation, locally called greenstone. The site of the Mariposa Mine is now the California State Mining and Mineral Museum which opened in 1990. (49).

PANEL DISCUSSION: 8:00 a.m. Saturday August 15

For the first segment of the field trip the Panel Discussion will be held at the California Mining and Mineral Museum.

After the panel discussion we will tour the California State Mining and Mineral Museum at the Mariposa County Fairgrounds. Optional gold panning will be available for $5.00.

BEGINNING OF FIELD TRIP

0.0 Leave the Fairgrounds parking lot, turn right and head north on Highway 140 toward Mariposa. At the Fairgrounds, the rocks are part of metavolcanic rocks of the Penon Blanco Formation.

0.2 Contact aureole of the Sierra Nevada Batholith

0.4 South strand of Melones fault zone crosses road at this point.

1.7/0.0 Intersection of Highways 140 and 49 at southern end of the town of Mariposa. Turn right and go north. Reset odometer.

Highway 49 at Mariposa begins in meta-volcanic rocks of Jurassic age of the Penon Blanco (metavolcanics) or Logtown Ridge (metasediments) formation and passes successively through meta-sedimentary rocks of the Calaveras formation, a serpentine intrusive body, more meta-sediments of doubtful age, and finally into the black slates and sandstones of the Mariposa formation. The narrow belt of rocks to the west of the serpentine near Mount Bullion was originally mapped as Calaveras but probably belongs to the Amador group and is Jurassic rather than Paleozoic in age.

0.3 Mariposa Courthouse

0.5 STOP #1A: Mariposa County Historical Center. Stop here to see demonstration of a stamp mill.

1.2 Intersection of Highways 140 and 49 at north end of town. Turn left, go west on Highway 49 toward Mt Bullion. For the next few miles we will transverse metavolcanics, Calaveras Group rocks, serpentine bodies and Mariposa Formation.

1.3 King Midas Mine on left.

1.8 CDF Fire Station on right

3.8 Serpentine. Mt. Bullion is on the right at 2:00

4.2 Black slate.

4.4 Mt Bullion Youth Camp on right

4.8 Mariposa airport

5.2 MOUNT BULLION

From Mount Bullion to the divide where the highway begins its drop into Merced River canyon, the rocks on both sides of the road belong to the Mariposa formation.

Mount Bullion, 4.7 miles northwest of Mariposa, was once a flourishing mining center being the site of the Princeton mine and the supply center for placer diggings close by. Evidences of hand placering are manifest along every stream bed and gravel exposure. The Princeton mine was opened in 1852 and up to 1933 was the largest producer in Mariposa County. Gold in excess of $4,228,000 was recovered up to 1915 since when very little work has been done. The shaft is inclined at angles varying between 45° and 60° and falls to an inclined depth of 1660 feet. The vertical depth is slightly greater than 1350 feet. The Carlo Marre recent Frank Trabucco store, across the street, mark the center of present day Mount Bullion (49).

5.6 Hornitos Road on left (West)

MERCED FALLS AND HORNITOS

5.6 miles north of Mount Bullion a road from Hornitos and Merced Falls joins Highway 49. Hornitos is the hub of a very old mining district, the town having been founded by Spanish Californians before gold rush days. The Mount Bullion-Hornitos road cuts successively across the strike of Mariposa nd Amador group rocks and then enters exposures of Guadeloupe granodiorite near the town of Hornitos. The Ruth Pierce mine is at the contact of the uppermost member of the Amador group, the Agua Fria formation, and the Guadeloupe granodiorite. The Agua Fria formation consists of thin-bedded, hard, platy sediments and interbedded volcanics. It lies, in different areas, both uncomfortably and gradational on the Penon Blanco or Logtown Ridge member of the Amador group and may be a nonvolcanic member of that formation. The latter formation is, typically, a green meta-andesite agglomerate having prominent augite phenocrysts. This formation persists in more or less parallel alignment to the Mariposa slate from Mariposa county well into El Dorado County.

6.4 Narrow part Melones Fault Zone

WASHINGTON OR JENNY LIND MINE

The Washington or Jenny Lind mine, 1/2 miles northeast of Hornitos has been one of the best in the Hornitos district. It was located in 1850 and installed the first milling machinery of not in the district in 1851. The stamp mill which operated in the 50' is repute dot have turned out $1,000 in gold per day. The vertical Jenny Lind shaft is 1540 feet deep. The recorded production is $1,099,000 and the estimated production, $2,247,000 (49).

MOUNT GAINS MINE

The Mount Gaines mines, located five miles northeast of Hornitos on the Hornitos-Bear Valley road, is the only major gold producer in Mariposa County. It has an inclined shaft with an average dip of 30° having a total inclined depth of 1322 feet. The ore is of sulfide type and the veins dip at 30° to 35° from horizontal. Steeply dipping veins are more common along the Mother Lode, in this respect, therefor, the Mount Gaines veins are unusual. The wall rock is meta-andesite and vein argentite have include pyrite, quartz, chalcopyrite, galena, and sphalerite as well as disseminated gold. Bornite, proustite, arsenopyrite, and argentite have been found in small quantities. Early production of the Mount Gaines totaled $1,250,000 to 1911. No recent figures are available (49). In recent years a heap-leach gold operation has been taking place at Mt. Gains.

6.7 Ophir Mine Rd. Metavolcanics (Penon Blanco Formation) are in hills to right (East). Mariposa Formation is in hills to left (West).

9.0 Quartz veins. South of Bear Valley marks one branch of Mother Lode. Two and two-tenths miles south of the town of Bear Valley prominent outcrops of quartz can be seen to the west of the highway. These stand up like white walls on the gently rolling land surface and mark the trace of one branch of the Mother Lode (49).

9.6 "May" Rock on left.

10.2 Bear Creek on left has been worked by placer miners.

11.5 BEAR VALLEY

Bear Valley, originally called Simpsonville, was promoted by J. C. Fremont during his administration of the Las Mariposas grant. The town is now largely a ruin of small stone, adobe, and frame buildings marked by Division of Highways Historical Marker 331. Another road from Hornitos joins Highway 49 just north of Bear Valley (49)

11.6 Historical Marker #331 for Bear Valley. Hunter Valley Mountain is the ridge to the west.

11.9 Pendola Creek Rd. on left.

11.7 Bear Valley Rd to Hornitos and Yellowstone Mine

12.5 Substation power house on left (west).

12.7 Dozer Cuts in Mother Lode

13.0 STOP #1C: MERCED RIVER CANYON OVERLOOK

Two miles north of Bear Valley and one-tenth of a mile past the divide marking the drop into Merced River canyon, a broad shoulder in the highway affords a good parking place from which to observe the panorama to the northwest. The river has cut a gorge which is over 1200 feet below the level of Bear Valley and more than 2000 feet below the ridge tops on either side. Remnants of the old rolling land surface can be seen on the ridge to the east of the river. Hell Hollow, which is a narrow gorge tributary to the Merced, lies immediately below the road to the northwest. The first fossils by which the age of the Mariposa slates were determined came from outcrops in Hell Hollow. To the east of the Merced River and more or less parallelling its course, the white outcrops of the main branch of the Mother Lode can be followed for miles. In the vicinity of Whites Gulch, the quartz outcrops take an abrupt turn and strike almost due north. It is possible that the Mother Lode, at that point, is offset by a cross fault, but work on that area has been insufficient to establish the fact conclusively. The abrupt change in strike of the Mother Lode outcrops is very noticeable from several points along Highway 49 as it drops from Bear Valley into the canyon of the Merced. The Mother Lode thrust fault system has displaced many thousands of feet of beds. More than 15,000 feet of strata may have been cut out in some places. Steeply dipping linear outcrops of meta-volcanics of the Penon Blanco or Logtown Ridge formation can be seen in the hillside to the west of the Merced River (49).

From this point, the Josephine and Pine Tree mines can be seen as dozer cuts to the east. From here we will descend to Hell Hollow which is an important site for fossil collecting. The fossils help geologists determine the age and sequence of geologic events along the Mother Lode.

13.4 Quartz outcrops in roadcut on right (east).

13.5 Mariposa Slate in road cut.

13.9 PINE TREE AND JOSEPHINE MINES

These properties are still active. Recent ore piles can be seen on the left (west).

The mine buildings, cyanide tanks, and adits of the Pine Tree and Josephine mines lie in a gulch between the two major switchbacks between bear Valley and the Merced River Bridge. These mines were opened about 1850 and were among the earliest of the lode mines. As the veins outcrop on the flanks of a

ridge of considerable height, they have been worked largely by tunnels and winzes rather than deep shafts. None of the workings extend lower than 800 feet from the tunnel levels. Some of the veins have been traced for 1200 feet along their strike. Production records on these mines are incomplete, but the total figure for both nines is in excess of $2,679,000. Prominent exposures of veins of the Mother Lode system can be seen in roadcuts in the vicinity of the Pine Tree and Josephine mines. A narrow belt of serpentine discontinuously parallels the Mother Lode fault east of eh the vein system. Between the highway drops down rather abruptly across a typical section of the Mariposa formation. The rocks are mainly black slate with interbedded lenses of black, arkosic sandstone. The sandstone contains fragments of slate which are probably re-worked Mariposa material. The slates weather to a tan or grayish buff as they approach the soil mantle. Just before the road crosses the Merced river, the Mariposa is exposed in fault contact with serpentine. Serpentine has sheared into the Mariposa at some points along this contact. Calaveras meta-sediments lie to the east of the serpentine belt (49).

14.0 Serpentine on right (east).

14.1 Road on left leads to Pine Tree and Josephine Mines.

14.2 Exposure of serpentine on north and south sides of Merced River. White rocks are the Mother Lode.

14.5 Tailings of Pine Tree/Josephine Mine at 12:00

14.6 Tunnel (closed) and sigh "contaminated water" on left (east).

15.2 Descending Hell Hollow at hair pin turn. Note abrupt changes in orientation of the Mariposa Schist/slate.

16.7 Bagby bridge over Merced River/Lake McClure and abandoned town of Bagby. Both sides of bridge expose serpentine, the state rock of California. At Bagby there is a fault contact between serpentine and Mariposa Formation to the right (east) of bridge the bridge. Bagby ruins are at the river's edge.

BAGBY (BENTON MILLS)

The site of the hamlet of Benton Mills, now known as Bagby, lies just across the Merced River. A stamp mill which processed gold ore from Fremont's mines above was situated there. None of the old buildings remain although foundations of some can still be locate. The Yosemite Valley Railroad once passed through Bagby but only the roadbed now remains. The tracks were removed during World War II (49).

At this point on the Merced river, suction dredging operations can often be seen.

17.0 Serpentine body in road cut at Vista Point sign and overlook.

North from bagby for a distance of over six miles, Highway 49 winds up a steep slope through a barren area of serpentine and related basic and ultra-basic rocks. Serpentine ordinarily is not a favorable medium for supporting plant life although some species grow luxuriantly on it. Vegetation here is exceedingly sparse and consists principally of California holly and chemise with an occasional digger pine. The serpentine series of rocks invades the basement sedimentary series in late Jurassic time intruding paleozoic and Mesozoic rocks alike. The body of serpentine north of Bagby is one of the largest areas of this type of rock to be round along Highway 49 (49).

17.1 Fault contact between serpentine and Mariposa Formation.

18.2 Red Bank Mine on left (west).

20.1 Scott Gulch on left (west).

20.4 Prospect pits on left.

20.7 Alligator Rock

22.4 Bagby Grade Summit in serpentine. To the northwest is the Merced River and Lake McClure area. Penon Blanco peak is at 10:00. Quartz of the Virginia Mine are in foreground, across the valley.

Slightly less than two miles beyond the summit of the Bagby grade, the highway crosses the eastern border of serpentine and continues along the contact of serpentine and Calaveras rocks of a distance of about a mile. The first good exposures of the Calaveras rocks for a distance of about a mile. The first good exposures of the Calaveras to be seen northbound along Highway 49 are exposed there. These outcrops consist mainly of weathered tan mica schist and phyllite both of which somewhat resemble weathered Mariposa slate. They have, however, suffered a much greater degree of metamorphism, being schistose rather than slaty (49).

22.7 Within a few hundred feet we cross fault zones separating metavolcanics and serpentine.

23.5 Calaveras Formation.

23.6 Road to Virginia Mine to left (west). Dike swarm on right.

A distance of 1.7 miles north of the Bagby summit, the highway crosses several dikes on an unusual grayish white rock known variously as albitite, soda syenite, and albite granophyre. Intrusive bodies of this rock are also found in many places to the east of Moccasin Creek. It is rock is medium to fine grained with aplite plus variable amounts of soda-rich minerals such as riebekite and aegirine. The latter two are not present in the dikes crossing Highway 49 but are present in some of the Moccasin Creek outcrops (49).

23.7 White quartz vein forms ridge on left (west). This is the structure that was excavated at the Virginia Mine.

VIRGINIA MINE

A short distance north of the summit of the Bagby grade, 3.8 miles from Bagby, a narrow dirt road from the Virginia mine leads off to the west. The virginia mine was one of the earliest patented claims in Mariposa County and has been worked on a small scale over a very long period. The mine is 1300 feet deep on the incline and the wall rocks are Calaveras schist, Logtown Ridge greenstone, and serpentine. Records are incomplete but known production is in excess of $660,000 (49).

24.3 Dikes (albitite, soda syenite, albite, granophyre)

24.9 Buckhorn Creek. Buckhorn Flat is an exhumed pediment surface which represents a former topographic leveling of the land in this area.

25.0 Albite dikes

25.4 MARY HARRISON MINE

A red brick furnace and chimney and a concrete foundation are all that remain of the boiler house and other buildings of the Mary Harrison mine. These are located on a knoll to the west of Highway 49, 1.8 miles south of Coulterville. The Mary Harrison was discovered sometime before 1867 and was operated for a considerable period prior to 1895 by the Cook Estate. In 1895, the mines of the Cool Estate passed into the ownership of the Merced Gold Mining Company which is responsible for most of the recorded production. This was well in excess of $330,000. The mine was worked to a depth of 1200 feet by shaft and winze. Most of the workings were in the dolomite-ankerite-mariposite-quartz rock which forms a very broad zone along this part of the Mother Lode. The mine has not been operated since 1903 (49).

Immediately north of the ruins of the Mary Harrison, the highway has been cut through the main part of the Mother Lode vein system. This locality is easily accessible and is an excellent place to observe the minerals which are associated with gold ores. Beautifully banded rocks composed of mariposite (chrome mica), white quartz, and carbonate minerals, such as dolomite, ankerite, and calcite, can be collected there. Talc schist is present in some places-probably derived by the shearing of serpentine. The gold ore itself consists of gold bearing iron pyrites, usually somewhat oxidized (49).

26.4 Louisa Point Hill on left

26.8 MAXWELL CREEK BRIDGE AND COULTERVILLE

26.9/0.0 Coulterville Historical Monument #332. Reset to 0.0.

STOP #1C: Coulterville. Our optional lunch stop will be at the Jeffrey's Hotel ($8.00). A historical lecture will accompany lunch.

After lunch we will walk south of town to see an exposure of quartz and mariposite on Highway 132 toward lake McClure.

Another excellent exposure of the veins of the Mother Lode is in the vicinity of Maxwell Creek bridge two tenths of a mile south of Coulterville. Many invasions of vein material along the same line of weakness can readily be seen in these exposures. The white silica-carbonate vein rocks are accentuated, in many places by rust-colored zones which mark the positions of sulfide-bearing gold horizons. Other yellowish-brown zones are made up of a leached, pulverized vein material which represents intra-mineral or post-mineral movement along the Mother Lode fault system (49).

The town of Coulterville is situated in a small valley which is at about the same elevation as Bear Valley. Coulterville was founded abut 1850 and was the center of a placer and gold quartz mining district which embraced the Malvina, Louisa, Potosi, Champion, and Tyro mines as well as the Mary Harrison. Many fine old buildings still remain including one built and operated by chinese. An old mine locomotive and other pieces of early day mining equipment are on exhibit directly across the highway from Division of Highways Historical Monument 332 (49).

COULTERVILLE TO CHINESE CAMP-GEOLOGIC MAP 2

Between Coulterville and Moccasin creek canyon, Highway 49 passes over a rough region of serpentine and greenstone resembling the terrain north of Bagby. The principal features of scenic and geologic interest along this part of the route are the many white-tipped comb-ridges which mark the surface trace of the Mother Lode quartz veins.

0.5 Gabbro of Horshow Bend

1.0 Re-enter the Melones Fault Zone

2.6 Serpentine at Penon Blanco Road.

2.8 Penon Blanco on to right (East)

PENON BLANCO

This series of quartz exposures was named the Penon Blanco or white cliff by Spanish californians. Although the long white walls are hardly tall enough to be considered cliffs, the name has persisted through the years. The weather-resistant quartz has kept the softer country rock, which forms the flanks of the ridges, from being obliterated by erosion. The best views of the Penon Blanco may be had at a sharp bend in the highway 3.2 miles north of Coulterville, and again at the divide which marks the boundary between Mariposa and Tuolumne Counties, about five miles northwest of Coulterville (49).

3.1 Campground on left with white quartz outcrops of the Mother lode.

3.3 Penon Blanco on right (east)

3.8 Oro Rico Mine

4.0 Tuolomne County Line

4.2 Oxidized red gabbro-diorite.

4.5 Penon Blanco on right (east)

4.7 McAlpine Mine and vein

5.2 Penon Blanco Point on right.

5.3 Haigh Mariposite Quarry road on right.

6.1 Mariposa Formation in fault contact with Serpentine.

6.3 MOCCASSIN CREEK

Two-tenths of a mile below the horseshoe bend where Highway 49 drops to the level of Moccasin Creek, the serpentines end against the Mariposa slate. The latter lies in a deep synclinal trough which is disrupted on both eastern and western sides by faults. The Mother Lode thrust-fault system which lies to the east of the syncline is a broad mineralize zone which in places reaches a width of more than 180 feet. Along The western fault contract, the Penon Blanco or Logtown Ridge andesite agglomerate has been sheared into the Mariposa slate in many places (49).

6.6 Moccasin Creek with several placer workings occur along it

6.7 Bridge with placer workings on both sides.

7.7 Placer workings on left (west)

8.1 Active placer operation on left (west)

8.5 Bridge over Moccassin Creek

9.0 Placer workings with large cobbles on right.

9.6 Moccasin Creek Power House

At the Moccasin Creek dam and powerhouse of the city of San Francisco, a d road joins highway 49 which connects with the old placer mining district of Big Oak Flat (49).

10.1 Road to Big Oak Flat (Dam). Go straight toward Chinese Camp. This area is the East Belt of the Mother Lode. The Soulsbyville Mine is in this area.

BIG OAK FLAT

Big Oak Flat can also be reached via Highway 120 which crosses Highway 49 2.2 miles farther north. The placers of Big Oak Flat together with the adjoining Deer Flat and Groveland district are credited with production in excess of $25,000,000. A few miles northeast of Big Oak Flat in the vicinity of Soulsbyville, several highly productive mines are located in what is known as the East Belt. The East Belt roughly parallels the main Mother Lode about five miles to the east of it. Veins of this belt tend to be discontinuous and much narrower than the main Mother Lode system and cut granodiorite or rocks close to it rather than meta-sediments and meta-volcanics. The most productive mines in the Soulsbyville vicinity were the Soulsby with a production of $5,500,000, and the Black Oak with a production of $3,500,000 (49).

10.3 Trout Hatchery on right (east).

10.5/0.0 Intersection of Highway 49 and 120. Turn left toward Sonora. Rocks in this area are serpentine melange. Reset to 0.0. Old Highway 49 followed the east side of the Tuolumne River.

A short distance beyond the intersection of Highways 49 and 120 the former crosses the Tuolumne River and continues into Jacksonville along the northwest bank of the river. This is the most scenic part of the southern third of Highway 49. There are good picnic spots along the river, several areas suitable for water sports, and the one of the few eating places between Coulterville and Jacksonville (49).

1.5 Deformed pillow lavas of New Priest Grade.

Good exposures of greenstone and schists of the Calaveras formation can be seen in road cuts at the south abutment of the Tuolumne River bridge and westward along the roadbed of the Hetch-Hetchy Valley Railroad to the serpentine contact. Calaveras rocks are also exposed in roadcuts along Highway 49 from the bridge to the Harriman mine (49).

1.6 Don Pedro Reservoir on right.

2.1 Moccassin Point turnoff.

2.3 Turnoff to Vista Point and Don Pedro Placer Workings.

3.6 Mine on right, across river.

4.0 MOFFATS BRIDGE

Less than half a mile southwest of Jacksonville and a short distance west of the junction of Woods Creek with the Tuolumne River, the abutments of old Moffats bridge can be seen jutting out into the Tuolumne River. The vicinity of Moffats bridge and the adjacent Hetch-Hetchy Valley Railroad cuts present good exposures of the Mariposa formation in which fossils are found. These occur in a conglomerate and were first described by H. W. Turner in the 1880's. The fossils include cephalopod and pelecypod molluscs of upper Jurassic age which correspond to Oxfordian stage fossils of Europe. Fossil leaves are also present. West from Moffats bridge, the Tuolumne River has cut directly across a 2500 foot ridge of agglomerate and serpentine. This represents a vertical downcutting t the edge of the gorge of more than 1800 feet (49).

4.1 Tuolumne River

4.3 Turnout for historical marker for Jacksonville.

10.5 Intersection Highways 49 and 120. Turn left, go north toward Sonora.

14.0 Harriman Mine on right (North).

HARRIMAN MINE

The Harriman mine is located close to old highway 49, 1.8 miles southeast of Jacksonville. In 1949 the headframe, sheet metal buildings, and mine dumps were very conspicuous at the roadside. Considerable capital was invested in this mine but no great production was ever recorded (49).

4.3 JACKSONVILLE

Jacksonville, founded in 1848 and named for Colonel Alden Jackson, was a supply and amusement center for the mines along Moccasin and Woods Creeks. There is little or no mining activity there now. A paved road from Jacksonville connects with Jamestown via Stent and Quartz (49).

5.9 Placer diggings on left.

6.3 Serpentine

7.6 Road to Shawmut Mines. Once accessible on old Highway 49, the Eagle-Shawmut is now reached from the west on this road which connects to new Highway 49.

EAGLE-SHAWMUT MINES

The extensive dumps and large mine buildings of the Eagle-Shawmut mine are located less than two miles northwest of the now inundated town of Jacksonville at the foot of the Shawmut grade. This is one of the many gold mines along the Mother Lode which were forced to shut down because of wartime limitations on gold mining and postwar high operating costs. The Eagle-Shawmut has many miles of workings and has produced huge tonnages of low grade ore. The total vertical depth of the mine via shaft and winze is about 3550 feet from the surface outcrop. The main shaft dips at an angle which averages 65° and has been entered for many years from adit number two. Ores in the mine consist of auriferous quartz, gold bearing massive iron sulfides, and gold bearing ankeritized country rock. The mine was opened at a very early date, being a consolidation of the old Eagle and Shawmut claims. However, most of the extensive workings were driven since the turn of the century. The Eagle-Shawmut has a recorded production of approximately $7,500,000. With the exception of the Eagle-Shawmut, few mines in the Jacksonville district contained ore of sufficient grade to warrant major

development. The gold values are disseminated through the wall rock in association with pyrite in what is locally called gray ore (49).

5.1 Road cut in Mariposa Formation.

5.9 Placer tailings on left (South)

7.6 Shaw Mountain Road

8.1 CHINESE CAMP: Tuolumne County Visitor's Bureau and Chinese Camp.

After passing the Eagle-Shawmut mine, Highway 49 winds up the narrow Shawmut grade to Chinese Camp. The summit of the grade affords an excellent northwesterly view of the flat surface of the Table Mountain lava flow. The road-cuts along the Shawmut grade expose Mariposa slates and green Logtown Ridge agglomerates. After passing the divide, the highway crosses gently rolling country in which there are few exposures of basement rocks.

Chinese Camp was a placer-mining center first settled by Chinese laborers in 1849. Ruins of structures built in the fifties still remain together with a few more modern dwellings. Piles of soil and gravel which were turned over in frantic search for gold can still be seen in every gulch. These gravels are reworked remnants of pre-existing Eocene and later tertiary deposits most of which have since been tripped off by erosion (49).

TUOLUMNE TABLE MOUNTAIN

The prominent flat surface of Tuolumne Table Mountain lies 2 1/2 miles northwest of Chinese Camp. Though appearing as a table when viewed from the road, it looks more like a sinuous river when seen from the air; and that is what it is -a fossil river-an ancient stream canyon cut in a broad flat sheet of volcanic ash but filled to the brim by a viscous flow of dark colored lava extending for 60 miles from the high Sierra Nevada to its terminus against a bluff of sedimentary andesitic beds near Knights Ferry. As the Sierra Nevada mass was raised and tilted slightly westward, the softer ash beds were largely washed away by erosion, leaving the very resistant lava flow high and dry as a dominating table. In places the stream which originally cut the channel later occupied by the lava, cut clear through the ash beds and even into the tops of some underlying buried hill tops of bed rock. In other places where the ash beds lay deep beneath the lava stream, the pre-volcanic stream courses under this older ash cover that the older gold placers were discovered and mined, as in the old New York tunnel. The younger channel of Table

Mountain was largely barren go gold.

The resistant latite lava flow of Table Mountain, which is probably of late Pliocene age, has thus protected some of the earlier softer Tertiary deposits form obliteration by erosion. The latite lave capping is flat-topped, with vertical cliffs along the edge, showing columnar joining of the rock. Tuffs and mudflows are exposed under or close to the base of the cliffs. The latite closely resembles a porphyritic olivine basalt, the potash feldspars being entirely confined to the groundmass. Some plagioclase crystals, however, are more than an inch long.

Andesitic tuffs, gravels and boulders can be seen lying directly beneath the latite at Mountain Pass, where the ancient stream channel, now occupied by the lava, cut a V-shaped gorge in the andesite cobble deposit. At this point is a watering place known as Mountain Springs, located less than a mile from the junction of Highways 49 and 108 or 4 1/2 miles from Chinese Camp. An area suitable for picnicking adjoins the spring and water fountain. The water flows from the ancient ash-covered bed of the Tertiary channel (49).

MOUNTAIN PASS

The bouldery andesite is known as the Mehrten formation and is well exposed on the road southeast of Mountain Pass. It lies stratigraphically above the Eocene quartz gravels which are present lying on bedrock. Some of the earlier quartz gravels, however, a mile northeast of Mountain Pass occur intermixed with the andesite cobble. These deposits represent post-Eocene channels which cut through the earlier Eocene deposits and robbed them of their gravels and also their gold.

The earliest gold-bearing stream channels, Eocene in age, often followed the strike of bedrock, cutting gutter and depositing gold nuggets. The andesite cobble was spread far and wide, covering both the bedrock and the Eocene channels. The much later latite lave flow took the course of a prominent post-andesite stream gorge and filled it to the brim. Where drift mining discovered the deep Eocene quartz gravel channels, rich placers were found; but where the mines encountered post-Eocene channels cut only through the barren volcanic ash, disappointment was the result. For this reason only a few of the drift mines which pass under Table Mountain were successful; many others were a disappointment (49).

The highway, from Mountain Springs and on into Jamestown, more or less parallels the trend of Table Mountain. Bedrock exposures are poor because of the low relief, there being few good outcrops until Woods Crossing is reached. The Mariposa slates appear briefly from beneath the Tertiary gravel and andesite series, and then are faulted off against a thin belt of Logtown Ridge metavolcanics. This contact is close to the junction of the Montezuma cutoff and Highway 49 about 2 1/2 miles northeast of Mountain Springs. From that point to Woods Crossing the basement rocks are principally serpentine and related gabbro-diorite (49).

8.4 Intersection 120 / 49, keep right, go North East toward Sonora. Reset to 0.0.

0.8 View of Table Mountain at 12:00

1.6 Cross Railroad. In the 1949 guide, Highway 49 went east to old Highway 106, then north to Jamestown.

2.3 Montezuma Horse Ranch with old Water Tower. This was a ghost Town in 1949.

3.4 Intersection Highway 49 and 108. There is a commemorative sign here. Lava Flow on hill North of intersection turn right (East) toward Sonora at loads Creeks.

5.4 WOODS CROSSING

Woods Crossing, now a cross roads rather than ford, has several interesting features. It is marked by a sign commemorating the passing of Bret Harte and Mark Twain through the gold country which was placed there by the Tuolumne County Chamber of Commerce in honor of two authors who did much to bring the color of the "Days of 49" before the public. A short distance to the west of the crossing, the buildings of the Harvard mine can be seen on the slope of Whiskey Hill. This mine was discovered in 1850 and was worked continuously until 1916. The prominent quartz-ankerite outcrops close to which the ore lay also outcrop conspicuously in the long roadcut between Woods Crossing and Woods Creek. The multiple nature of the vein system can readily be seen there and some minerals, such as the attractive mica mariposite, can be obtained. The veins,lie along the contact of Calaveras schist and the serpentine body mentioned in preceding paragraphs. The Harvard has two shafts but only one was used to any great extent. The main shaft has a 700 foot vertical drop and then turns at an angle of 58° to a depth of 1850 feet. The veins have been worked for 1500 feet along the strike of the Mother Lode. Post-mineral faulting has displaced the ore shoots from

8 to 20 feet in some places. A 60 stamp mill employing 1200 pound stamps in on the property. some recent development work has been done, but no attempt at major production has taken place in recent years. The Harvard has a know production of $2,036,697 but no records were kept Prior to 1897, and a much larger figure is probable (49).

12.7 STENT AND QUARTZ MINES

To the east of Highway 49, a road leads of to the old mining camps of Stent and Quartz. Both can also be reached from roads out of Jacksonville and Jamestown, being about 2 1/2 miles south of the latter. In addition to local placering, Stent and Quartz are famous for a group of hardrock mines the best know of which are the App, Dutch Sweeney, Heslep, and Jumper. The Jumper has recently been rehabilitated but no recent production has yet been reported. It is a consolidation of the old Jumper, New Era, and Golden Rule claims, the combined production of which is more than $3,000,000. The presence of the gold tellurides petzite and hessite has been reported from the Jumper. Combined production of the App and Heslep has been placed at more than $1,742,000 and that of the Dutch and Sweeney at approximately $2,118,000. These were fairly deep mines, the Dutch having a vertical depth of about 2070 feet (49).

Beyond the Mother Lode vein exposures at Woods Crossing, a very thick section of Calaveras rocks begins. The Calaveras formation can be seen on both sides of Highway 49 from Jamestown to well beyond the Calaveras River bridge. The rocks are mica schists, phyllites, limestones, and green metavolcanics. Several more or less parallel branches of the Mother Lode traverse the Jamestown-San Andreas strip, and the vein systems tend to finger out into the wall rocks in many places, forming networks of veinlets or stringers. Some of the stringer lodes were extremely auriferous and were responsible for the famous pocket mines of Rawhide and Jackass Hill. Some of the ore bodies on Carson Hill were of this type. It is probable that a great deal of high grade ore of this nature was eroded off during Cretaceous and Eocene time to form the fabulously rich placers of Columbia and Shaws Flat (49).

4.8 STOP #1D: Jamestown Mine

This recently rejuvenated operation is a cyanide heap leach gold project. A bus will be provided for us by Lynn Fox and Sonora Mining Company.

After the mine tour we go to the Sonora Townhouse Inn in Sonora.

4.9 Harvard Mine Rd. Jamestown (Harvard) Mine on slope of Whiskey Hill.

5.7/0.0 JAMESTOWN

Jamestown or Jimtown, as it is familiarly called, is a still thriving community with a history dating from 1848. It long has been the supply center for a great many small mining camps, and the major workings at Stent and Quartz has been mentioned in previous paragraphs. Another one leading off northwesterly from the center of town crosses Table Mountain, goes through the ghost town of Rawhide, and rejoins Highway 49 about a mile east of Tuttletown. This route crosses Table Mountain close to the old Tuttletown-Jamestown segment of the abandoned Sierra Railroad. A closeup view of the latite lava cap and underlying tuffaceous sediments can be can be seen in the railroad cut close to the road. The rim, or contact with bedrock along the old slope of the fossil stream bank, shows in the old weathered surface of the covered schist, a cross section of surface hillside creep which has preserved since the lava covered it. Close by this spot gold bearing gravels lie beneath rhyolitic lake beds, covered by bridge. The New York tunnel was one of the few drift mines under Table Mountain which could boast any considerable profit. Its heyday was prior to 1868 (49).

Jamestown has Federal reserved minerals under it.

0.0 Head northeast on Highway 49 toward Sonora.

0.2 RAWHIDE (SIDE TRIP)

West of the Table Mountain crossing, a distance of seven-tenths of a mile, the Rawhide road joins one from the Old Omega mining district. Southeast of this road junction the red sheet metal stamp mill of the successful, the mill has been in operation for much of the time and is one of the few stamp mills still in operation along the Mother Lode. The mill site is of further geologic interest because a post-latite normal fault, Pleistocene in age, passes almost under it and then cuts through Table Mountain, displacing the lava cap a vertical distance of 60 feet, the western side being higher than the eastern.

The site of the old mining camp of Rawhide lies a short distance north of the Omega-Rawhide road junction almost due west from the railroad cut on Table Mountain. A body of pure antigorite serpentine lies to the south and west to the town of Rawhide. This was extensively prospected during the war as a possible source of magnesium. The Rawhide mine, also located close to the town of Rawhide, was on of the most successful early day mines. It was very active up to 1867;

was idle until 1891; and had a very productive period up to 1905. Since then only pocket mining in the old workings had been done. The veins are typically quartz-ankerite rock containing both free gold and gold bearing sulfides. The wall rocks are Calaveras schist and serpentine. The total depth is 1845 feet via shaft and winze. Probable production is in the neighborhood of $6,000,000 (49).

0.4 SHAWS FLAT

0.4 Road to Shaws Flat in Mariposa Formation

Four-tenths of a mile north of Jamestown a road which leads to Shaws Flat joins Highway 49. Shaws Flat is accessible from Sonora and Columbia also. The town was founded in 1850 but the rich placer diggings of the Shaws Flat-Sonora district were discovered in the summer of 1848. As at Columbia, which is but a few miles to the north, the Calaveras limestone underlies most of the diggings and has an extreme rough, hummocky, crevasse, pothole, surface, caused by surface leaching of ground water and probably accomplished, for the most part, since the gold was deposited. Much of the gold was found in the red, weathered clay of the limestone, and not directly on the bedrock. Some of the Eocene gravels which once covered the limestone surface can be seen, but they are scarce because they were probably stripped off this surface by; erosion long before the days of 49. Although exceedingly rich, the Shaws Flat deposits were very shallow and were soon worked out. The source of the gold from these early rich placers may well have been close by; for north of Sonora on the road to this area is a hillside covered with early pocket mines. No accurate breakdown on the production of Shaws Flat, Whimtown, and other diggings in the Shaws Flat vicinity are available, but it is probable that part of the $87,000,000 credited to Columbia came from diggings to the south. Some of the channels of this district were followed partly under Table Mountain, separated from it by deposits on andesitic cobble.

Between Jamestown and sonora, the countryside becomes more hilly and it rather well forested. There are several resorts and picnic spots along the highway and several nice stands of pine timber. The rocks along the way are Calaveras schists and green stones of no particular interest (49).

1.9 Columbia State Park Exit in Calaveras Group rocks. Take exit to stay on Highway 49.

2.5 Sonora city limits

3.1 Fairgrounds on right (east)

3.7 Intersection Highways 49 and 108. Turn left (west) toward Columbia. Reset odometer to 0.0.

END OF DAY #1

DAY #2: JAMESTOWN TO JACKSON

This day begins with a panel discussion at Angelino's Hall at Columbia State Park at 8:00 a.m.

0.3 Sonora Courthouse on left.

0.5 Historical Marker 139: St James Church

SONORA

Sonora, one of the larger foothill towns and county seat of Tuolumne County, was founded in 1848 by Spanish Americans. It is flourishing and attractive town with its yellow frame County Courthouse and rustic red St James Church. Sonora boasted a newspaper as early as 1850. The Holden Chispa nugget which weighed over 28 pounds was taken from diggings within the present city limits. An excellent collection of gold specimens may be seen at McKibbens Mountain Cafe on the main street of town. Historical Marker 139, placed there by the American Automobile Association and State Division of Highways commemorates St. James Church, and the Tuolumne County Chamber of Commerce has erected a monument to the early pioneers of the city located at the divided part of the main street through town. Sonora is the gateway to the Pine Crest Resorts and Sonora Pass in the High Sierra (49).

0.0 to 5.0 Limestone and Tertiary gravels between Sonora and Columbia

1.3 Limestone outcrops in Calaveras Complex.

3.1 Columbia turnoff on Parrots Ferry Road.

4.3 Winery with stamp mill in right

4.4 Airport in Limestone and Columbia Elementary School.

4.5 Rock shop and Columbia

4.6 STOP #2A: Columbia State Park

4.6/0.0 COLUMBIA

Two miles northwest of Sonora is the famous placer mining camp of Columbia. The trip to Columbia from Highway 49 is well

worth the traveler's time. The vicinity of Columbia has been made a state park. St. Ann's Church, a red brick structure located to the south of town, has all of it's old charm. the search of its old charm. The search for gold is said to have stopped at the church grounds and remnants of the gold gravels supposedly lie untouched beneath the church. The rough limestone bedrock, which is much like that at Shaws Flat, is credited with having caught and held gold to the fabulous sum of $87,000,000. Few if any gold placers of similar area have yielded so rich a harvest! Several very large nuggets were taken from the Columbia diggings. A slab-shaped mass found on Knapp's Ranch weighed over 50 pounds avoirdupois, and $8,500 in gold was recovered from it. Another from Gold Hill weighed 362 troy ounces valued at $6,500 respectively. The town contains many interesting buildings, a local-color museum, and a sweatshop par-excellence. State Division of Highways Historical Marker 123 marks the turn onto Colombia's main street (49).

For the next part of this field trip, the tour will depart from Highway 49 and go through the town of Vallecitos. Appendix I contains information about the mining camps of Tuttletown, Arbona Mine, Jackass Hill (Chileno) Group, Norwegian Mine, Robinson's Ferry (Stanislaus River), Melones, and Carson Hill.

0.7 Turn right on Parrot's Ferry Road. Go north toward Vallecitos.

3.2 Marble quarry road

3.4 East end of Table Mountain

3.8 Tuolumne River canyon on right with exposures of limestone. The contact between the granodiorite and the limestone has caused widespread mineralization in this area.

5.2 STOP #2B: Old Parrot's Ferry Bridge (usually submerged) is now exposed due to the drought.

6.4 New Parrot's Ferry Bridge. Most rocks that are visible are of the Calaveras Complex.

7.4 Snake Gulch.

7.6 Calaveras limestone

7.8 Natural bridge trail to grotto-like cave that Coyote Creek flows through.

10.1 Moaning Cave Park is on the left (west).

10.9 Vallecitos Tertiary channel goes through the town of Vallecitos.

11.0/0.0 Intersection of Parrot's Ferry Road and Camp 9 Road. Turn right, go east on Camp Nine Road toward the Camp Nine Limestone Quarry.

VALLECITO

Vallecito is two and a half miles southwest of Douglas Flat. At the town of Vallecito a road from Columbia joins Highway 4. This road starts north from Columbia, following the Eocene Columbia River channel, passing close to a large marble quarry in Calaveras limestone to the east, and then descending the deep and spectacular canyon of the Stanislaus River. On the way one may look up this magnificent canyon and limestone. Table Mountain latite shows up prominently on the north side of the canyon as well as the south, and as the road winds down through granite rock various fine scenes come into view until finally it crosses the river at Parrots Ferry. Here one should examine the outcrop of granitic rock with inclusion of earlier intruded rock bodies and then look upward 1000 feet higher to the two stubs of the severed Table Mountain latite. On the north side may be seen high up on the canyon wall the V-shaped cross-section of the lava-filled channel, cut in granitic rock. Before the uptilting of the Sierra Nevada, this lava occupying the sinuous course of what may have been the ancestral Stanislaus River, flowed across this place, then at a much lower elevation. As the Sierra Nevada block was raised and tilted slightly westward, the present newly born Stanislaus River, flowing down the Sierra slope cut and carved a canyon through the lava and underlying rocks, keeping its course as the Sierra surface rose, and cutting deeply into the granite. Not only is this lava-filled channel cut in two, but also the earlier Columbia channel is bisected. A continuation of this channel which was left just north of Columbia is again encountered on the road as it reaches the old surface after the climb out of the canyon. The roads follows along this ancient channel and the edge of the present Coyote Creek canyon at the bottom of which, 300 feet lower in elevation, is a Natural Bridge or remnant of a limestone cave through which the creek now flows (49).

0.7 Nine Hill Tuff capping Vallecitos gravels.

1.3 Latite tuff ridge on left (north). This is a continuation of Table Mountain.

1.9 Saddle on Camp Nine Road.

2.4 Mehrten volcanics on left (north).

2.5 Limestone Reef on right (south).

2.8 Columnar jointing on right. The columns have been rotated from their original vertical position by soil creep.'

3.2 Fallen columns of latite on left.

3.4 Cattleguard.

3.6. Decomposed granite quarry on left.

4.0 STOP #2C. Calaveras Camp Nine Limestone Quarry.

Return to Parrot's Ferry Road.

0.0 Intersection of Parrot's Ferry Road and Camp Nine Road.

0.6 Intersection of Parrot's Ferry Road and Highway 4. Turn left, go south toward Angel's Camp

3.9 to 4.5 Vallecitos Tertiary channel in road cuts.

5.0 Six mile Creek

5.1 Angels Camp in metavolcanic rocks.

5.7/0.0 Junction Highways 49 and 4. Turn right, go north on Highway 49. Reset odometer.

0.1 ANGELS CAMP Historical Marker on left (west).

Angels Camp 3.8 miles north of Carson Hill town, was founded in 1848 by Henry Angel. It is modern up-to-date town with few buildings of historical interest remaining. Although its stream placers were rich, the lodes proved richer and more permanent. Some were exploited as late as 1920 (49).

0.1 UTICA (dark) MINE on left.

The Utica mine, which was a consolidation of the Utica. Stickles, Raspberry, and six other claims, is by far the most famous mine between Carson Hill and Jackson. Although fires and cave-ins hampered production from time to time, the Utica produced gold to the amazing total of nearly $17,000,000. The veins and hence the shafts are nearly vertical and the deepest part of the mine is 3050 feet below the surface via shaft and winze. The veins are faulted off on the south side of town and attempts to relocate the ore shoots south of the cross-fault have failed. The working shaft and adjacent stopes are located on the north side of town in an area now set aside as a city park. The depressed portion of the park is the result of the caving of the stopes beneath (49).

0.1 GOLD CLIFF MINE

A half mile west of the Utica is the Gold Cliff mine, which was operated by the Utica Mining Company for about five years after the Utica closed down. It is on the main Mother Lode fault system whereas the Utica is probably on the same east spur as are the Carson Hill ore bodies. The averaged 45° in dip, but most of the ore came from above the 1900 foot level. Between the 1600 and 1700 foot levels, the ore bodies are offset to the north by a nearly horizontal fault of several hundred feet displacement. The Utica Mining Company announced a total production for the Gold Cliff of $2,834,000 (49).

The Gold Cliff and Utica were later connected at the 1500 ft. level (91, p.51).

0.2 CHLORINATION PLANT (removed).

Two-tenths of a mile from the junction of Highway 4 and 49 in Angels Camp the site where the old Chlorination plant is located. Chlorination was an early day method of recovering gold from concentrates before the process of cyanidation was discovered (49).

0.5 Lighter Mine on left (west).

0.7 Angels Camp museum.

0.9 Angel's Camp Mine is 1/2 mile to the south of this point and produced over 157,000 ounces of gold.

ALTAVILLE TO MOKELUMNE HILL - GEOLOGIC MAP 4

1.1 ALTAVILLE

Altaville, located at the junction of Highway 49 and 4 one mile north of Angels Camp is, like its larger neighbor a modern town with but few remaining historical spots. Originally known as Cherokee Flat. Altaville was a crossroads point of supply for adjacent placer mines. A group of drift mines which has produced much placer gold is located to the east of Altaville and Angles Camp. The term drift mines is here applied to underground placer mines which reach the old buried river gravels by shafts and tunnels (49).

Information on the Calaveras Central and other mines east of Angels Camp and on a side trip through the Murphy's Grade Loop are contained in Appendix II.

1.4 Turn off to Copperopolis at Altaville Highways 4 and 49. Go straight on highway. This area is underlain by metavolcanics.

COPPEROPOLIS (SIDE TRIP)

The 1949 guidebook contains the following statement about wildlife on the side trip to Copperopolis:

> "Several interesting sidelight on the wildlife of the vicinity may be observed along the Copperopolis route. Telephone poles and fence posts are riddled by the acorn studded holes of California woodpeckers. The fence posts are further burdened by the carcasses of dozens of predatory animals which the ranchers have trapped or otherwise disposed of. It seems to be a custom of the country to exhibit "varmints" in this fashion. No less than 34 coyotes and three bobcats were strung on consecutive fence posts within a two-mile stretch on the authors' last trip through that country!"

The Copperopolis copper mining district 12 miles southwest of Altaville was a major producer through both World Wars but has been idle much of the time between war periods. The North Keystone, Empire, and Keystone-Union are the principal mines of the district and are all located in its town within a short distance of each other. The Copperopolis mines were discovered in 1861 and for several years thereafter were the principal producers of California copper. The upper parts of the ore bodies were very rich and the Union and Keystone mines paid huge dividends. The Copperopolis mines are on a fault system as are the Mother Lode gold mines, but the Copperopolis mines carry little gold and lack the quartz-carbonate gangue of the Mother Lode veins. The ore is of simple sulfide type, principally pyrite and chalcopyrite slate at peripheries of the ore shoots. The ore bodies lie in a narrow belt of hydrothermally-altered black slate of the Mariposa formation with Logtown Ridge meta-andesite agglomerate on either side. Dikes of diorite cut the Logtown Ridge in many places near Copperopolis paralleling the strike of the bedded rocks.

The town of Copperopolis, located in the center of Salt Springs Valley, has but few buildings remaining. The red brick I.O.O.F. Hall, originally built in 1862 as a church, is one of the few still in a good state of preservation. A Mr. McCarty had mined and farmed in Salt Springs Valley as early as 1852 and had prospected the copper veins for gold. Finding no gold, he paid no further attention to the copper deposits until he returned with two others in 1861 and helped to found Copperopolis. The history of Copperopolis has been one of periods of great activity interspersed with periods of virtual abandonment (49).

The copper district is now the site of a gold operation that produces gold by simple milling.

5.4 San Domingo Creek in metavolcanics.

6.5 Ruins on right (North)

6.8 Fourth Crossing

7.0 San Antonio Creek

9.4 CALAVERITAS CREEK

North from Altaville there is little of geologic interest along the highway until Calaveritas Creek is reached. The gently rolling grazing land is probably much like the ancestral Eocene land surface. Remnants of auriferous gravels can be seen to the east of the road particularly between Calaveritas Creek and San Andreas. The bedrock is schist and greenstone of the Calaveritas formation. In several places along Calaveritas Creek, both southeast and southwest of San Andreas, limestone lenses occur in the Calaveras which are suitable for use in making Portland cement. Although parts of the lenses are dolomitic and carry too high a magnesia content for cement, excellent bodies of cement-grade limestone occur in them and are being exploited at the present time. The Calaveras Highway 49, 2 1/2 miles south of San Andreas. The company allows visitors at its plant which is well worth going through. Historic Kentucky House is located near by. The Plant can be reach ed by tow different roads connecting with Highway 49 close to San Andreas. A private road and overpass which connects the plant to its eastern limestone quarries crosses Highway 49 at the Calaveritas Creek Bridge.

7.7 Calaveras Group rocks on ridge at 11:00

8.1 Calaveras Country Airport on left (south).

9.3 Calaveras Cement Company railroad overpass in Calaveras Formation.

11.1 Calaveras Cement Mine to left (south).

11.7 San Andreas

12.4 Flashing yellow light in downtown San Andreas. Turning right at this point will take us to the San Andreas Museum. We turn left and head south toward the Western Stone limestone/aggregate mine.

13.5 Poole Station Road. Turn left, go southeast toward Western Stone Mine.

14.4 STOP #2D: Water-filled quarry.

After seeing this water-filled quarry, we return to San Andreas.

16.4/0.0 SAN ANDREAS

San Andreas, as the name implies, was first settled by Spanish Californian miners prior to the advent of the Yankee. As usual they were persecuted and driven out of town whereas other minority groups such as the Chinese were allowed to remain. Present day San Andreas is an buildings dating from as early as 1851. Division of Highways 12 connects with the old towns of Railroad Flat and Westpoint to the northeast boasts both the County Courthouse and County Museum. The museum occupies one of the best preserved, oldest buildings in town and contains rocks, minerals, artifacts. Indian handcraft,a nd miscellaneous objects and manuscripts of historical interest (49).

0.0 Intersection of Highways 12 and 49. Stay right on highway 49.

0.8 Murry Creek

1.0 North Fork of Calaveras River

MOKELUMNE HILL TO PLYMOUTH - GEOLOGIC MAP 5

Between Mokelumne Hill and the canyon of the Mokelumne River the terrain is hilly. The Tertiary gravel and volcanic series has largely been stripped off and the tributaries of the Mokelumne have badly dissected the old Eocene surface. West from town, Jackson Butte, a lofty volcanics plug, stands out above the other hills. Far beyond and to the northwest the metal water tank of the Argonaut mine can be seen on the ridge top. The bedrock along the highway is diorite and related plutonics until well beyond the Mokelumne River. A few gravel remnants outcrop near the road within sight of Mokelumne Hill.

0.0 Intersection Highways 12 and 49. Turn right (north).

0.6. Kate Hageman Mine on left (west).

KATE HAGEMAN (GOTTSCHALK) MINE: NORTH FORK OF CALAVERAS RIVER

Proceeding northward from San Andreas, Highway 49 traverses four miles of rolling grazing land of no particular geologic interest. The headframe and buildings of the Kate Hageman mine are located near the bridge which crosses the North Fork of

the Calaveras River, 2.2 miles northwest of San Andreas. The Kate Hageman was developed during the 1930's and considerable modern mill equipment was installed. Both opencut and underground mining has been attempted there. The mine has been idle for some time. Wall rocks are greenstone and slate; a serpentine contact is close by to the west. The creek bottoms near the Kate Hageman have been worked for placer gold (49).

QUARRIES

Near the junction of Highways 8 and 49, a group of underground rooms and quarries, from which rhyolite tuff building stone was taken, can be observed. Mokelumne Hill was fortunate in having so satisfactory a source of building material so close at hand (49).

Roadcuts to the west of Mokelumne Hill along Highway 8 afforded closeup views of the late tertiary volcanic sequence. Three miles from the junction of 8 and 49, a long cut exposes the trace of a low-angle thrust fault which cuts both the schist bedrock and the overlying Mehrten rocks. This is an unusual type of post-Pliocene faulting for this area, although the fault is probably not of major extent. The trace of this same fault can be seen in the undercut face of one of the volcanic plugs to be seen on the south side of the road three-tenths of a mile farther west. This group of plugs, of which there are three besides the Golden Gate plug considerably farther west, are made up of a rock described as hornblende andesite. These supposedly are the vents from which the Mehrten volcanics were derived (49).

1.2 Serpentine

2.0 Gold Strike Rd

3.2 Calaveras Group rocks in roadcut.

3.3 Hydraulic mine worked Central Hill Channel on right (east).

3.6 Tertiary gravels on left (west).

4.3 Tertiary gravels on top of hill at bend in road.

4.5 Spring Creek

4.8 CALAVERAS CRYSTAL MINE

The Calaveras Crystal is a drift mine driven beneath the Valley Springs rhyolite opposite the Chile Creek placer diggings. It can be reached via dirt road from Highway 49, the road joining Highway 49 form the est at a point 6.5 miles

from San Andreas or 2.5 miles from Mokelumne Hill. The mine is on a branch of the Mokelumne Hill channel system known as the Tunnel Hill channel. The large quartz crystals which have made the mine famous are partly of optical and electronic grade. Considerable quartz for this purpose was marketed during the recent war emergency. Crystals weighing as much as 100 pounds each have been taken from the Calaveras Crystal. An adjoining mine on the McSorley Ranch operated by the Rough Diamond Mining Company also produced considerable quantities of optical-grade quartz. Although not so well known as the Calaveras Crystal, reserves of quartz crystals in this mine appear to be greater than those of its more famous neighbor (49).

5.6 Road follows Chili Gulch.

CHILI GULCH TO MOKELUMNE HILL

Two miles northwest of the Kate Hageman mine, a rather extensive group of Tertiary deposits is exposed on both sides of the highway from the vicinity of Chili Gulch to Mokelumne Hill. The ancient Mokelumne Hill river channel once traversed this region in a southwesterly direction and was joined, in the Chili Gulch vicinity, by a tributary which entered from the direction of San Andreas. Remnants of the old channel gravels have been extensively worked for gold by hydraulic and other placer means. The lofty faces of the hydraulic pits are not visible from Highway 49 but some of the gravels are exposed in road cuts east of Chili Gulch. The gravels lie nonconformably on schists and greenstones of the Calaveras formation and are overlain by the rhyolite tuff of the Valley Springs formation and the andesite and andesite gravels of the Mehrten formation in that order. Unconformities exist between the Valley Springs is probably Miocene and the Mehrten is probably Pliocene at least in part. Cliffed outcrops of yellowish-gray tuff of the Valley Springs formation are prominent in many places along the Mokelumne grade. Exposures of the Mehrten can best be seen a short distance west of the town of Mokelumne Hill along Highway 8. A quarter of a mile south of the Calaveras Crystal mine, the Calaveras bedrock has been intruded by diorite. Dioritic rocks form the basement on which the Tertiary rests over a large area in the vicinity of Mokelumne Hill (49).

The Central Hill Channel is dissected by Chili Gulch thus enriching it.

5.9 Chili Gulch historical marker.

6.0 Drift (tunnel) mine to right (east) in Tertiary gravels.

8.4 Mokelumne Hill in granodiorite

MOKELUMNE HILL

Mokelumne Hill was founded in 1848 by ex-members of Stevensons Regiment of Mexican war fame. A stone historical monument erected by the Native Daughters of the Golden West is located close to the three story I.O.O.F. building. The latter buildings was erected in 1854 and added to in 1861 and is the first three story building in the Mother Lode country. Mokelumne Hill and Jackson once engaged in a feud over the problem of which town should get the honor of being county seat. Originally, Double Springs, some miles to the west of Mokelumne Hill, had acted as county seat until rapidly growing Mokelumne Hill claimed the honor. Jackson finally "seceded" from Calaveras County and formed a county and county seat all its own, now Amador County. The present Amador-Calaveras County line follows the course of the Mokelumne River i this area. San Andreas is now the county seat of Calaveras County. Highways 5 and 8 cross 49 at Mokelumne Hill, Highway 8 continuing on to the east to mining districts in the vicinity of Westpoint (49).

7.3 Intersection of Highways 49 and 26.

7.5 Turnoff to Mokelumne Hill. Turn right to go through town.

7.7 Mokelumne Hill historical marker.

8.4 Highway 49 and Center Street.

8.6 Jackson Butte Volcanic Plug at 3:00 on N side of Mokelumne River. The metal water tanks of Argonaut Mine, described in the 1949 guidebook can't be seen today.

8.7 Coral Flat Road.

8.8 Drift mine on right.

9.0 Tertiary gravels.

9.4 Mokelumne Canyon rim.

10.7 Workings on hill at 12:00. Mokelumne Bridge and Amador County line.

10.8 Quartz diorite outcrop.

12.1 BUTTE CITY MINING DISTRICT

12.1 Butte Store, Butte City Mining District Ghost Town and Historical Marker 39. This area is underlain by tuffaceous

gravels.

One and four-tenths miles north of the Mokelumne River bridge the road passes through a thick series of tuffaceous gravels which are part of the placer ground of the Butte City mining district. The site of Butte City can be located by the ruins of the Butte City 1.3 miles, an oiled road turns to the west which connects with the old placer camp of Middle Bar on the Mokelumne River about four miles from Butte City. The bridge which now crosses the Mokelumne is about at the old site. The river bottom is sometimes by the waters backed up behind Pardee Dam. Little Bar is commemorated by State Division of Highways Historical Marker 36 (49).

13.1 Middle Bar Road.

14.0 MOORE (ZEILA) MINE

The dumps and mine buildings of the Zeila mine are located close to Highway 49, six-tenths of a mile south of Jackson. The Zeila was first opened in the 1860's, was closed down during the latter half of the 70's and was a heavy producer from 1880 to 1914. The mine has an incline of 65° average dip. The ore occurs in quartz stringer in a gouge composed of decomposed rocks of several types. The veins lie on the contact of Calaveras slate and schist and greenstones of uncertain age. One drift is over 3000 feet long. Total production of the Zeila has been more than $5,000,000 (49).

Northward from the Zeila mine to the vicinity of Plymouth, a distance of about 12 miles, the Mother Lode has produced gold far in excess of $160,000,000. This is by far the richest yield recorded along the Mother Lode for any sector of equal length, and is exceeded in California, in total gold produced, only by the Grass Valley district of Nevada County. The geology of this highly productive strip is complicated both in structure and in lithologic similarities, and there are many diverse interpretations of the geology by those currently at work there. Most of the productive mines are on a branch of the Mother Lode fault which lies about a mile to the east of the Gold Thrust is nonproductive along this sector. The strike of these two faults is roughly N.30°W. and parallels the regional trend of the structure for the most part. Other faults of similar type and trend occur several miles to the west of Jackson and are undoubtedly other branches of the Mother Lode system. The Jurassic sediments and metavolcanics in this aria are badly deformed into a series of tight, overturned, isoclinal folds which have been further complicated by the several thrust faults mentioned above (49).

14.1 Clinton Road to the right (north).

CLINTON

A mile farther north, a road from Clinton leads off to the east. The Clinton Consolidated and Clinton Bar are the best known lode mines of the district. Clinton was a placer district before the lode mines were developed. State Division of Highways Historical Marker 37 marks the turnoff to Clinton (49).

14.2 Turnoff to Middle Bar on Mokelumne River

14.7 JACKSON

Jackson the county seat of Amador county, is a modern town combining the old with the new. Many of its old buildings have had their faces lifted so that one would hardly recognize their true vintage. Jackson bears the name of Colonel Alden Jackson who has also been honored by having the Tuolumne County town of Jacksonville named for him. The town dates from at least 1849 and probably before. Botilleas, the original name for the site, indicates that, like many other gold camps, Spanish Californians were the original settlers. Jackson is very proud of its one-time Congress man, benefactor, and native son, Anthony Caminetti, who did a great deal for Jackson and for Amador County in general. A monument to this memory has been erected beside Highway 49 immediately north of the business district (49).

14.8/0.0 Southern intersection of Highways 88 and 49. We will take a side trip to the Kennedy Wheels and get an overlook of the Kennedy and Argonaut mines. Then we will visit the Jackson Museum. This will end day two.

STOP #2E: KENNEDY WHEELS

KENNEDY WHEELS

To the north and east of Jackson Gate were the several huge wheels which were built in 1902 to raise tailings, or mill waste, from the ground level of the Kennedy mine, situated a half mile to the west, to the summit of a ridge beyond which lay the tailings disposal dump. Although partly dismantled, the wheels were once equipped with a circle of 176 buckets, a belt drive,a nd an electric motor each. They were 68 feet in diameter and raised the tailings a vertical distance of 48 feet each. The tailings elevators connected gravity flumes in which the tailing flowed from mill to dump. Sheet metal buildings once housed each wheel but these have been removed (49).

STOP #2F: JACKSON MUSEUM

After visiting the museum we will retire to the Jackson Best Western Motel.

END OF DAY #2

DAY #3: JACKSON TO AUBURN

This day starts with a Panel Discussion at the Wells Fargo Restaurant in Jackson at 8:00 a.m.

After the Panel Discussion we will proceed toward Placerville.

0.0 Leave downtown Jackson

1.8 Headframe of Kennedy Mine at left (east).

1.9 Argonaut Mine on left side of roadway adjacent to Highway 49.

2.1/0.0 Vista Point. This turnout has exhibits about the Kennedy and Argonaut mines. Reset odometer.

KENNEDY MINE

Two of the greatest mine on the Mother Lode are located slightly more than a mile northwest of Jackson. These were exceedingly large operations both above and below ground and are famous landmarks along Highway 49. The Kennedy, with its lofty headframe and huge sheet-iron-enclosed mill, lies a short distance to the east to Highway 49. The original Kennedy claim was located in 1856 and has since been consolidated with several others. It was a minor working until 1871 and had an inactive period between 1875 and 1885. From that time until final closing in 1942, the mine was operated continuously and on a major scale. The Kennedy was worked largely through vertical shafts to a vertical depth of 5912 feet, making it the deepest gold mine in the United States. There are approximately 150 miles of underground workings as well as extensive surface equipment which once included the Jackson Gate elevator wheels and the miles of flumes connected with them. A fair cross section of the history of gold mining and milling equipment may be gleaned from past reports of the Kennedy operations. The workings are in Mariposa slate and Logtown Ridge metavolcanics. Minerals described from the Kennedy include gold, quartz, pyrite, galena, fluorapatite, strengite, sphalerite, chalcopyrite, ankerite, and other carbonates. The total production of the Kennedy mine calculated on the present price of gold is $45,000,000. Recalculated to fit various price changes in gold, the production figure is approximately $34,280,000. The Kennedy has been idle since 1942 (49).

ARGONAUT MINE

The Argonaut mine, across Highway 49 to the north west of the Kennedy, can be located for many miles in all directions by its lofty water tank. It was first worked in 1850 but had only been developed to a depth of 150 feet by 1876. Except for tow one-year period, when operations were suspended because of fires, the Argonaut operated continuously from 1893 to 1942. The veins are largely continuations of those on the Kennedy property and the geology is similar. The mine was worked through inclined shafts to a depth of 6300 feet along the dip or 5570 feet vertically. There are eight miles of stope floors. The total production of the Argonaut to the end of 1943 was $25,179,160. The most recent operators of the Argonaut dissolved their organization in February 1948. The mine has been idle since 1943.

1.3 MARTELL

Martell, situated two miles northwest of Jackson, is the terminus of the Amador Central Railroad. In addition to its railroad facilities, Martell boasts lumber mill and curing yard. The logs are fed to the mill from an artificial pond. Trucks bring the log s to the pond from timberlands higher in the mountains.

1.4 Northern intersection of Highways 88 and 49. Turn left, head north past the Martell lumber yards.

1.5 Jackson Gate Road

JACKSON GATE

Jackson Gate was a small town located 1.5 miles north of Jackson which was reached via paved road from either Jackson or Martell. It has now been assimilated into Jackson. Although small, Jackson Gate was picturesque and was the possessor of a group of very interesting relics of the past mining ventures (49).

0.1 ONEIDA (not visible)

The old Oneida mine was situated close to the northeast of the present site of Martell. Only the mine dumps mark the site, the Oneida having been idle since 1913. It was one of the richest of the early-day lode mines, ore averaging as high as $40 a ton in the early 1860's. The Oneida has a 2280 foot vertical shaft and several shallower inclined shafts. An inclined winze sunk 250 feet from the 2280 foot level gives a total vertical depth to the mine of about 3500 feet. The total production of the Oneida is something in excess of $2,500,000 (49).

0.4 Martell Lumber mill on left (west).

0.9 Amador County Airport.

1.0 Junction of highways 49 and 108: Sutter Hill, South Eureka, Central Eureka and Old Eureka Mines.

1.1 Sutter Creek City Limits (Sutter Hill Mine).

1.6 Head frame for Central Eureka Mine to right (west).

EUREKA MINES

Three very productive mines are located near the junction of Highway 49 and 108 about a mile north of Martell. These are the South Eureka, Center Eureka, and Old Eureka. Headframes of the latter two can seen from Highway 49. The South Eureka located southeast of the Highway 108 intersection, was discovered at an early date buy was not developed until 1891. Much of the development and maintenance of this mine has been integrated with operations in the Central Eureka as has the Old Eureka, since 1924. The South Eureka has been worked to a depth of 4100 feet and has produced gold to the amount of $5,300,000 (49).

The Central Eureka, located north of the South Eureka across Highway 108, was discovered in 1855 and was called the Summit mine in its early days. It has a small production prior to 1865 but major exploitation took place after 1896. The Central Eureka and Old Eureka are among the few Mother Lode mines which have serviced wartime limitations on gold mining and the rising cost of operation. A great deal of credit is due the present management for being able to remain in operation when other large workings such as the Argonaut and Kennedy have been forced to close down. The Central Eureka shaft is 4965 feet deep along an average dip of 70° or about 4650 feet deep vertically. The wall rocks are Mariposa slate and graywacke and greenstone of the Cosumnes and Logtown Ridge members of the Amador group, all of Jurassic age. Authorities disagree on the early production figure for the Central Eureka is $17,000,000 (49).

The Old Eureka mine is located a half mile north of the Central Eureka headframe in the outskirts of Sutter Creek. It is an early day consolidation of the Eureka and Badger claims and had a very high early-day production. The old Eureka was first opened in 1852. Workings have been developed to an inclined depth of 3500 feet. A wide variation in early production figures sexist in various published reports on the Old Eureka. The most probable compilation of figures indicates a total production of about $17,400,000 for this mine (49).

2.0 SUTTER CREEK

The town of Sutter Creek was named after John A. Sutter who first visited the region in 1846 and mined there in 1848. Sutter Creek is a rather harmonious blend of older frame and recent stucco buildings nestled among low hills. A continuous row of gold quartz claims located along the Gold Thrust passes through the heart of Sutter Creek. Aside from the aforementioned Eureka group south of Sutter Creek, the most productive mines in this vicinity were the Wildman, Mahoney, and Lincoln now grouped together under the name Lincoln Consolidated. These mines were discovered 1851 and were worked both separately and together at various time throughout heir history. The Lincoln shaft, which was the deepest of the three, was sunk on n average angle of 63° to a depth of 2000 feet, giving a vertical depth of about 1760 feet. Ore bodies of mine between Sutter Creek and Amador City are mainly at the fault contact of Mariposa slate and Logtown Ridge meta-andesite. North of the Wildman, the veins were as wide as 45 feet near the surface. Combined production of the Wildman and Mahoney was slightly less than $5,000,000; the Lincoln is credited with $2,200,000 in gold (49).

2.1 Sutter Hill Road to right (east).

2.4 Downtown Sutter Creek in Mariposa Formation.

1.5 North Star Mine to right (west)

2.4 Road to Volcano

VOLCANO

An interesting side trip to the old placer and hydraulics mining center of Volcano can be made via good paved road east from Sutter Creek. The Volcano placers were discovered early in the 1850's and the town soon boasted a population of over 5000. The drive up Sutter Creek canyon is scenic and the town of Volcano, although partly in ruins, retains much of its early-day color. In common with Murphys and Columbia, Volcano has not been modernized. There are several limestone caves in the vicinity (49).

3.9 Lincoln Mine on right

3.9 Amador City limits

AMADOR CITY

Amador City, 2.2 miles northwest of Sutter Creek, is the locus of another group of rich mines. The Amador Creek placers were located in 1848 but were never very rich, and it was not until

the first lode gold strike in 1851 that Amador City begin to grow. Amador City has much the same setting and background as Sutter Creek which it resembles in many ways strangely enough a Baptist minister made the initial discovery in Amador county, which was firs known as the Minister's claim. Later it was developed into the Original Amador mine (49).

The original Amador, now a consolidation of six claims is a very complex working comprising over nine miles of drifts, crosscuts, and raises. These open off from a 1238-foot inclined shaft. Estimated total production for this mine is $3,500,000. The Original Amador is located about a fourth of a mile northeast of town (49).

The Amador mine has recently been reactivated.

4.8 Cross Amador Creek Bridge. The Spring Hill and Bunker Hill mines are to the east of this point.

4.9 KEYSTONE MINE

Best known and most productive of the Amador City mines is the Keystone, located southeast of town. It dates from 1853, being a consolidation of several pre-existing claims. Ore from these had been milled in arrastres from 1861 to 1863. The main shaft is 2680 feet deep along an average incline of 52°. Much of the ore taken from this mine was of sulfantimonide or sulfantimonide type which is somewhat unusual among Mother Lode ores. The total production of the Keystone is about $24,500,000 (49).

4.9 SOUTH SPRING HILL MINE

Immediately to the east of the Keystone is the South Spring Hill mine, located in 1851. The South Spring Hill shaft is 1200 feet deep along a 60° incline. Before passing into the hands of the Keystone interests in 1920, the mine had been credited with a production of $1,092,472 (49).

5.7 Rancheria Creek

6.6 Dry town Historic Marker in Logetown Ridge Formation.

7.4 DRYTOWN

Highway 49 turns west at Amador City and follows along Amador Creek for over a mile before turning north toward Drytown. The road cuts are all in meta-andesite of the Logtown ridge formation. A thick section of this formation is expose along this sector of the Highway (49).

Drytown was founded it the spring of 1848 when rich placer ground was discovered there. Its heyday was prior to 1857 before the placer diggings became exhausted. Drytown claims the distinction of being the discovery point of the first placer gold taken from Amador County. Division of Highway Historical Marker 21 is located near the junction of Highway 49 and the Drytown-New Chicago-Amador City road. The latter is paved and is an alternate route from Amador City to Drytown. Along this road are the old Mining camps of New chicago and New Philadelphia and the productive Gover, Bunker Hill, Fremont, Italian, and Treasure mines. The former two are credited with producing over $5,000,000 each. Such picturesque names as Lower Rancheria, Bloody Gulch, Rattlesnake Gulch, and Murderer's Gulch are connected with the placering in this vicinity.

7.5 Dry Creek

8.6 Intersection of highways 16 and 49. Turn right and go west on 49. This area is underlain by metavolcanic rocks.

9.5 "Tombstone" rocks in slate.

10.4/0.0 Plymouth and Empire Mine in Mariposa Formation.

PLYMOUTH

Highway 49 merges with Highway 16, 1.2 miles northwest of Drytown and bends sharply to the east for half a mile before continuing northward into Plymouth. The history of Plymouth is connected with the ups and downs of the lode mines nearby, which same were discovered vicinity. Like most other large Mother Lode mines, the Plymouth Consolidated is a merge of many old claims. At least 16 claims or parts thereof have come from the Simpson, Aden, and Oaks claims. The deepest part of the mine is at least 4450 feet along a shaft which is partly vertical and partly inclined. Although the veins are on a continuation of the same Gold Thrust on which the Amador City and Sutter Creek mines are located, the wall rocks in the Plymouth Consolidated are confined to Mariposa slate. The total production of the mine has been estimated at more than $13,500,000. The Plymouth Consolidated is the most northerly of the major mines of the Mother Lode. Above Plymouth, the veins contain much more limited ore shoots and finally fray out into stringer lodes or veinlet stockworks. The workings in Georgetown, Garden Valley, Greenwood, and Spanish Diggins are of this type (49).

Reset odometer.

0.5 Turnoff to Fiddle town

FIDDLETOWN

The old placer mining camp of Fiddletown can be reached by a paved road leading east from Plymouth. Fiddletown was settled by Missourians in 1849. The somewhat picturesque name was changed to Oleta in 1878 (49).

PLYMOUTH TO PLACERVILLE-GEOLOGIC MAP 6

Northbound from Plymouth, Highway 49 changes its northwesterly trend and goes almost due north for 12 miles. Over much of this distance the road lies in a narrow valley close to the watercourses of Big Indian Creek and the North Fork of the Cosumnes River. A mile above the old mining camp of Nashville, the highway crosses Logtown Ridge and drops into Logtown Ravine. The latter opens out onto low rolling meadowland in the vicinity of El Dorado. The land surface from Logtown Ravine on to Placerville has been resurrected by Quaternary erosion and the present topography is much as it was in late Cretaceous or early Eocene time. Bright red deeply weathered areas of the bedrock series and remnants of Tertiary gravels are evidence of the transformation (49).

1.7 Logetown Ridge is on left. This is the type locality for the Jurassic period rocks of the Mother Lode.

3.8 Placer workings on right in Big Indian Creek.

4.3 Enterprize School house

4.4 AMADOR STAR AND BAY STATE MINES on left (west).

The Amador Star and Bay State mines are in the vicinity of the Enterprise schoolhouse, four miles north of Plymouth. These are located on the west side of the highway and close to it. They are 40 years younger than the mines below Amador City and are much less extensive. Production has been intermittent and unspectacular (49).

5.4 Cosumnes River Bridge at Amador and El Dorado county line.

A mile farther north, Highway 49 crosses the Cosumnes River and Amador-El Dorado County line. The Cosumnes branches into two forks just above this spot, the South Fork cutting immediately across the ridge to the east and the North Fork flowing north for several miles parallel to the highway. West of the Cosumnes River bridge, also know as Huse Bridge, the river flows in a deep canyon cut through Logtown Ridge. A hike of a few miles down this canyon is well worth the geologist's time. Along the stream bed are exposed type sections of two members of the Amador group, the Logtown Ridge meta-andesite agglomerate and the Cosumnes meta-sediments composed of conglomeratic, sandy, and tuffaceous beds (49).

5.5 Mill tailing and foundation on right (east).

6.5 Logetown Ridge on left (west).

7.4 Nashville (Quartzburg) on right (east): Tennessee-Nashville Mine.

NASHVILLE (QUARTZBURG)

Two miles north of the Cosumnes River bridge is the old mining camp of Nashville or Quartzburg. The site of Nashville was originally an old Indian camping spot or rancheria, and the mining camp was one of the first lode camps in the state. The Tennessee-Nashville mine, also known as the Havilah, claims to have operated the first stamp mill in California, and ore from the mine was crushed in arrastres previous to that time. The Tennessee-Nashville was the first lode mine in El Dorado County and one of the first in the state. The stamp mill was manufactured in Cincinnati and brought around the Horn. Known production for the Tennessee-Nashville is in excess of $231,000 but there are no records for several periods of activity. The mine is about 1000 feet deep (49).

8.2 Sand Ridge Road in granodiorite

8.6 Union Mine Road to right.

8.7 MONTEZUMA MINE on the west side of road.

North of the Tennessee-Nashville a distance of 1.3 miles are the dumps of the Montezuma mine. The Montezuma had considerable elaborate equipment at the site in the 1930's but this has since been removed. The Montezuma has a history similar to that of the Tennessee-Nashville with which much of the development work has been connected. Immediately north of the Montezuma mine the old and historic Kings Store road leads off to the northeast. This road connects with the Red Bird, Union, Martinez, and Crusader mines which are along Martinez Creek. The Union is credited with being the largest producer in El Dorado County. Incomplete production figures indicate a yield in excess of $2,700,000 (49).

9.8 Logetown Ridge Formation (Jurassic metavolcanics).

11.7 On right (east) is Deadman Creek.

12.2 Ridge of porphyritic volcanics of the Logetown Ridge Formation are on the right (east).

12.2 Mine on right (east).

12.3 Monitor Road

12.3 Logtown Ravine

12.4 OPHIR AND POCAHONTAS MINES

Two mines, the Pocahontas and the Ophir, are located in Logtown Ravine close to Highway 49 between two and three miles southwest of El Dorado. They are of interest to geologists because the veins are on the contact of Logtown Ridge meta-andesite and a quartz porphyry and may not be related to the Mother Lode. The Quartz porphyry is closely associated with granodiorite in this locality and is either derived from it or intimately intruded by it. The Pocahontas is more than 1000 feet deep along a rather shallow dip of about 45°.

13.0 STONE BUILDINGS AND ARRASTRE

Two miles south of El Dorado several ruins of old stone buildings can be seen on either side of the highway. The best preserved of these is a partly dugout structure half of which is below ground level. A substantial part of the walls are made from granodiorite arrastre stones. Arrastres were used extensively in connection with the mines between Plymouth and Placerville and their partly shaped stones made good building blocks. The Arrastre method of grinding ore was borrowed from the Spanish californians but it is probable that those in the El Dorado district were "Yankee" made (49).

14.9 El Dorado Historical Marker #486

EL DORADO (MUD SPRINGS)

El Dorado, originally known as Mud Springs, was a camp on the Carson Emigrant Trail long before gold rush days. The name was changed during the height of the gold rush at the time of the incorporation of the town. Although attractively situated in the midst of a lumbering, cattle grazing, and gold mining region, El Dorado has never gained the impetus toward growth enjoyed by its near-neighbor Placerville. A sawmill and lime plant are located close to town and many early day buildings, both well preserved and in ruins, can be seen there (49).

15.1/0.0 Intersection on Highway 49 and Pleasant Valley Road. Turn right and go east toward Placerville. Rocks in this area are Jurassic metavolcanics of the Logetown Formation.

1.5 Stop light. Go straight (east) on Highway 49.

2.0 Diamond Springs Road in granodiorite.

DIAMOND SPRINGS

Diamond Springs is located near one of the richest of the early day placer diggings in the vicinity of Placerville. Like El Dorado, it was an emigrant camp before gold rush days. Both Diamond Springs and El Dorado are to one side of the Highway 50 cross-country route but are served by railroads and are active lumbering town (49).

2.2 Turn left on Highway 49 at stop sign toward Placerville.

2.5 Texas Hill Tertiary Channel on left.

3.1 Cross Weber Creek Bridge. Area underlain by Mariposa Formation.

3.5 PACIFIC QUARTZ MINE

In addition to the placer diggings, several lode mines were developed near Placerville. The most successful of these is the Pacific Quartz mine situated on a hill on the south side of Placerville. It is about 2000 feet deep via vertical and inclined shafts and winzes. The ore is gold-bearing arsenopyrite containing considerable silver. Some ore bodies are in tale schist. The wall rocks are Mariposa slate. There are intrusive bodies of serpentine near by which have been altered to tale-schist in some places. Such tale and serpentine rocks are exposed near the supermarket parking lot on the main street of Placerville. The Pacific Quartz mine has a recorded production of $1,486,000 (49).

4.1 Coon Hollow portion of Tertiary channel hydraulic workings can be seen through the trees on the left (east). These workings are on the Texas Hill Tertiary Channel.

4.2 Placerville City limit

4.5 Crest of Sacramento Hill capped with Tertiary volcanics (tuff/dacite) which overly Tertiary gravels.

5.5 Hydraulic workings at 12:00

6.0 Pacific Street. Turn left into Placerville.

PLACERVILLE

Placerville was founded in 1848 either by James Marshall or a Cosumnes river rancher named William Daylor. Both were there at different times in the spring of '48. Placerville was known variously as Old Dry Diggin's and Hangtown, but was incorporated as Placerville in 1854. Placerville is the county seat of El Dorado County with lumber, railroad, and

tourist interests. It is served by Highways 49 and 50 and by the Southern Pacific Railroad. The place is filled with old buildings and other spots of historical interest which have been adroitly preserved among the modern structures of the town. Many of the old buildings have been rehabilitated and house many types of business enterprise. Placerville is also justly proud of its newer structures such as the County courthouse building. Few places in California are as steeped in early-day history as Placerville. Old placer and hydraulic diggings surround the town on all sides and appear within its limits; fine old churches abound; and the pine-covered hills to the east of town form a fitting backdrop. J.M. Studebaker, who later founded an automobile empire, learned his trade in the blacksmith shops of Placerville. Although the gold of the vicinity has been largely dissipated, the timber and water resources remain and the county still flourishes (49).

STOP #3A: Gold Bug Park

Once in Placerville, we will go east and then north a short distance to the Gold Bug Mine and city park. We will eat lunch at the mine. The entrance fee is $0.50. We will then have a short time to explore Old town Placerville and the Placerville Museum.

0.0 Intersection of highways 50 and 49. Go straight (north) toward Auburn. The rocks at this intersection are of the Mariposa Formation.

0.8/0.0 Junction of Highways 193 and 49.

PLACERVILLE TO AUBURN-GEOLOGIC MAP 7

From Placerville, Highway 49 resumes a northwesterly trend and soon leaves the Mother Lode to traverse an area almost lacking in lode mines and having but widely scatted placer camps. The relief steadily increases because of the proximity of The many forks and tributaries of the logged-off areas are covered with brush. For about for miles, Highway 49 traverses a bedrock of Mariposa slate, Logtown Ridge meta-andesite, intrusive quartz porphyry, and Calaveras schist; beyond that limit the bedrock is granodiorite for a distance of over eleven miles (49).

1.7 Porphyritic volcanic rocks of the Logetown Ridge Formation.

1.9 Calaveras Group rocks.

2.4 Granodiorite

3.7 Turnoff to Gold Hill on left (west).

5.2 Calaveras Group rocks on Murphy Mountain to the north across American River canyon.

6.3 Kidder Corner on Granite Hill Road.

7.0 Coloma State Park Boundary

7.3 Marshal Gold Discovery State Park

7.5 Visitor's Center turn off to left (west). Each vehicle must pay a park entrance fee.

7.5/0.0 STOP #3B: COLOMA

Coloma, site of Marshall's discovery of gold in 1848, lies in a valley traversed by the South Fork of the American River. The gravels from which Marshall washed the gold which made history are not the old Eocene deposits from which so much placer gold was taken, but rather are reworked Quaternary sands and gravels. The gold found along present day Sierran Rivers is derived partly from recent erosion of gold lodes but more generally from recent erosion of pre-existing stream deposits. The timberlands which first interested Marshall have, for the most part, been cut off, the gravels were soon exhausted and Coloma is largely a town of memories. The vicinity of Sutters Mill and the hill which overlooks it to the southwest have been set aside as state parks. On the south side of the west side of the main street. Centennial observances have resulted in the erection monuments and a local-history museum (49).

0.8 Lotus turnoff at left

LOTUS

Downriver from Coloma a distance of 1.5 miles is the placer camp of Lotus. Lotus was first known as Marshall and then as Uniontown. It once had a population of 2000, but this swindled to a handful once the placer were exhausted. Two fine old brick structures remain on the site. A paved road connecting Lotus with Shingle Springs and Highway 50 passes through town and at its northern outskirts joins Highway 49. The Stuckslager mine is located near this road one mile south of Louts. This pocket mine was unusual in that the gold was associated with the vanadium mica roscoelite. Roscoelite is a very rare mineral found in few other places int eh Unite States. It occurred in fine greenish-brown or clove-brown scales associated with quartz and gold. None has been taken from there for some time (49)

0.9 Bridge over South Fork of the American River

1.3 Turn off to Garden Valley on Marshal Road.

GARDEN VALLEY

Half a mile north of Lotus, a paved road turns northeast from Highway 49 which connects with Garden Valley. The latter in a very scenic pate of the Mother Lode which will be discussed in later paragraphs. Two and a half miles beyond this junction is the ruin of Meyer's Dance Hall and Wine Cellar. This local "miners' delight" was built in 1855 and the scene of many a gay escapade. It has been marked as a historical site by the El Dorado County Chamber of Commerce (49).

2.6 Bacci Road

2.8 Granodiorite boulders. Roadway parallels the American River.

4.5 Luyama Road to right (north).

5.1 Luyama copper mine on right (north) side of road.

LUYAMA COPPER MINE

The Luyama copper mine is located 5.4 miles northwest of Coloma close to Highway 49 on the north side. The Luyama is a minor working developed before World War I. It is one of the few contact-metamorphic copper deposits in the Sierra foothills. Copper values were in chalcopyrite associated with pyrite, magnetite, and a little gold and silver (49).

5.4 Black Rock Creek

7.4 Pilot Hill Placer diggings in metavolcanics.

PILOT HILL

Eight miles beyond Lotus the old landmark Pilot Hill marks the placer diggings and town of that name. Pilot Hill is not on the American River and its diggings were in a remnant to Tertiary gravel which lies on a greenstone bedrock of uncertain age. Fremont and his men were reputed to the first "Americanos" to visit the vicinity of Pilot Hill in 1844. Mining began there in 1849 but Pilot Hill was principally a jumping-off place for the mines which were higher in the mountains (49).

A tributary to the ancestral American River comes through Pilot Hill.

7.7 Red ranch house on left is underlain by Tertiary Pilot Hill Tributary gravels.

7.9 Folsom Lake turnoff.

8.1 Old Baily House Hist Monument underlain by metavolcanics.

8.8 Rolling terrain represents early Tertiary topography.

8.9 Free-standing chimney on left (west).

10.3 Cave Valley Road. This marks the southern end of the Cool limestone body.

11.3/0.0 Cool townsite and intersection of Highways 49 and 193. Go straight (north) toward Auburn.

COOL

Slightly more than four miles north of Pilot Hill is the crossroads known as Cool. This was an early-day placer camp.

See Appendix III for a description of a side trip to Garden Valley.

Resuming the way up Highway 49 from Cool, the route is through serpentine and then along a narrow limestone belt bounded on both sides by greenstones of uncertain age. An enormous thickness of green meta-volcanics is exposed between the limestone quarries and Auburn. The North Fork of the American River has cut a tremendous gorge into this rock and the exposures in the river bed and the road cut leading down to it are excellent. This meta-volcanic series may be a northern facies of the Logtown Ridge meta-volcanics but accurate correlation has not yet been established (49).

0.9 to 1.1 COOL LIMESTONE QUARRIES

These mineral deposits are lenses of limestone surrounded by metavolcanic rocks.

A mile and a half north of Cool, a group of limestone quarries can be seen on the north side of the highway. Limestone was first quarried and burned there some 40 or 50 years ago by the Cave Valley Lime Company. One of the od kiln can be seen close to Highway 49 near the abandoned quarry, a quarter of mile south of the orad turnoff to the main workings. The kiln wall were made of limestone lines with greenstone. Local wood was used to fire the kilns. The present operators of the quarry, the Sprekles Company (formerly the California Rock and Gravel Company) quarry and crush the limestone for conversion into lump lime but do not produce either lime or cement themselves (49).

1.1 STOP #3C: Sprekles Limestone Mine. We will get a geologic lecture and tour of this mine.

1.4 Open pit on right (northeast).

1.9 Drop into the Middle Fork of the American River canyon.

A mile beyond the limestone quarries, Highway 49 winds down to the bottom of the canyon of the North Fork of the American RiveR. Both branches of the North Fork are deeply incised and transverse profiles appear youthful. However, an aerial view of the course of the river shows a series of broad entrenched meanders indicating that the pattern has been superimposed from an ancestral land surface and that the V-shaped transverse profile is produced by rejuvenation. Half a mile from the bridge, the junction of the North and Middle Forks of the American may be seen (49).

2.7 Forest Hill Divide Bridge is on the right (north).

3.4 Junction of North and Middle Fork of the American River at 2:00 in metavolcanic rocks.

3.5 Placer County line.

3.5 BRIDGE OVER THE AMERICAN RIVER

The American River bridge is at the El Dorado-Placer County line. The river is both wide and deep at this point and the effect of deep green water against green rocks is striking. The massive greenstones strike diagonally across the river and have been planed off and polished below high water mark. The remnants of the Railroad bridge and roadbed of the Pacific Portland Cement Company Railroad can be seen close to the old highway 49 bridge. This railroad formerly connected the limestone quarries along the American River with the Southern Pacific tracks at Auburn. The rails were removed during the last war (49).

Today the remains of the old Highway 49 bridge can be seen to the west of the present bridge.

3.5 to 5.5 The drive up the north side of the American River canyon exhibits outcrops of greenstone and other metavolcanic rocks.

5.3 Auburn city limits.

AUBURN

Placer County was created from a portion of Sutter County in 1851. Auburn acted as county seat of Sutter County. Auburn has always been a transportation center and large lumber and cattle interests have long been connected with it. The De Witt army hospital is located north of town. Highway 40,

which connects with Reno and other transcontinental points passes through. Auburn and it is served by the Southern Pacific Railroad (49).

We take highway 49 through Auburn to the Placer County Courthouse and the Placer County Mining Museum at the Placer County Fairgrounds. We then return for dinner in oldtown Auburn.

5.5 Lincoln Way and Highway 49. Go straight toward courthouse.

6.7 Courthouse. Turn left toward Placer County Fairgrounds.

7.0 STOP #3D: Placer County Mining Museum at Placer County Fairgrounds.

After visiting the Museum, we return to Old Town Auburn.

STOP #3E: Old Town Auburn

After dinner in Old Town, we retire to the Auburn Best Western Motel.

END OF DAY #3.

DAY 4: AUBURN TO GRASS VALLEY

This day starts at 8:00 a.m. with a Panel Discussion in the Club House at the Placer County Fairgrounds in Auburn.

STOP #4A: Club house at Placer County Fairgrounds.

From the Fairgrounds, proceed to the intersection of Highways 49 and 80. Reset odometer.

AUBURN TO NORTH SAN JUAN - GEOLOGIC MAP 8

Between Auburn and the Bear River, Highway 49 traverses rolling open grassland broken here and there by patches of brush and scrub trees. The somewhat monotonous landscape to the north of Auburn gives no inkling of the splendid scenery soon to be in evidence from Grass Valley to the end of Highway 49. The bedrock between Auburn and Grass Valley is mainly green meta-volcanics of doubtful age which have been intruded by irregular bodies of serpentine and by basic dikes of several types. Between the forks of Dry Creek a narrow belt of Calaveras meta-sediments begins which rather closely parallels Highway 49, on its westside, as far north as Rattlesnake Creek. The Calaveras rocks are mainly mica schist, chert, and limestone. There are large granodiorite intrusions near Grass Valley and the bedrock from Nevada City to North San Juan is principally of plutonic igneous rock approaching granodiorite in average composition. All the Quaternary stream and bench gravels have been worked for gold. Tertiary deposits are absent between

Auburn and Grass Valley along the route of Highway 49. There are no mines of any consequence south of the Grass Valley district of which the Bullion claim of the Idaho-Maryland Mines Company, Ltd., is the southernmost member (49).

0.0 Highway 49 underpass with Highway 80. Head north toward Grass Valley on Highway 49. The rocks in this area are greenstones, serpentine and Calaveras Group schist.

3.2 De Witt Center. The roadcuts for the next 3 miles expose metavolcanic and metasedimentary rocks.

3.3 OPHIR MINING DISTRICT

Three miles west of Auburn near Highway 40 is the Ophir mining district. Ophir, first known as Spanish corral, was one of the main placer camps of Auburn ravine and has since been the main gold-quartz mining center of Placer County. Although little is left of the town, the orchard and vineyard landscape is attractive.

6.0 HOTALING (CLIPPER GASP)

Six miles northeast of Auburn at Hotaling, near Clipper Gasp, one of the earliest iron mining operation in California was locate. Clipper Gap and Hotaling can be reached via Highway 20 east from Auburn. The Hotaling iron mine was located in 1857 but no ore was shipped until 1869. The deposit was in the form of lenses at the contact of granodiorite and a metamorphic series of probable Paleozoic age. The ore minerals were magnetite and hematite containing from 40 percent to 65 percent iron. A blast furnace was operated on the property between 1880 and 1885 using charcoal made locally and limestone mined near by. It produced thirty to thirty-five tons of pig iron daily. Although red and yellow ocher were shipped from the vicinity in the late 1920's for mineral paint, no attempt to exploit the lower grade ores for their iron content has been made since the turn of the century.

9.6 Dry Creek Road at Elder's Corner

9.8 Marguerite Mine Road to small hardrock mine.

11.7 Bell Road to airport.

10.7 South Fork of Dry Creek. At this point there is serpentine to right (east) and Calaveras Group rocks to left (west).

14.0 North Fork Dry Creek in Calaveras Group rocks

13.6 BEAR RIVER BRIDGE

Highway 49 crosses the Bear River and the Placer-Nevada County line 8.7 miles north of Auburn. The vicinity of the Bear River bridge is of considerable geologic interest and is an attractive spot for fishing enthusiasts and pleasure seekers. A major thrust fault diagonally crosses the Highway in a NW-SE direction and the crumpled rocks along its trace are an interesting study. West of the bridge along the eastern bank of the river, the sheared and crumpled meta-volcanics of the Lake Combie Complex are in places, a lattice-work of silica-carbonate veinlets. Discontinuous, irregular bodies of serpentine appear along the contact, and the crumpled volcanics include fragments of chert and limestone. East of the bridge a few hundred yards, the massive greenstones contain amygdaloidal horizons and represent quiet lava flows rather than the pyroclastic beds seen to the west.

7.6 U-name-it ranch with placer workings.

7.8 Combie Road in metavolcanics.

8.1 Pillow basalt metavolcanic rocks.

8.2 Serpentine in roadcut

8.6 South Fork of Wolf Creek with Overland emigrant trail Historical marker #799.

8.8 Higgins Corner with Combie Road leading to Combie Dam on the right (east).

HIGGINS CORNER

Two miles north of Bear River is Higgins Corner. A road connecting with the hamlet of Wolf leads off to the west and another to the east leads to the Combie Dam and Reservoir on Bear River. A prominent outcrop of Calaveras chert forms a reef just west of the highway 2.3 miles north of the south fork of Wolf Creek. This reef is almost vertical in attitude and is associated with greenstones of uncertain age. This is one of the few exposures of chert to be seen close to Highway 49 south of the Yuba River.

9.2 Vertical bed of Calaveras Chert.

9.3 Carriage Road.

13.2 Contact between green metavolcanics and granodiorite.

10.7 Cherry Creek Road and Holcomb Road in metavolcanics. The Stockton Hill Mine is on the left.

10.8 Donner Party emigrant trail.

12.1 Lime Kiln Road

LIME KILN (JONES RANCH)

The Lime Kiln or Jones ranch was the site of a series of limestone quarries and kiln where limes for mortar was prepared at a very early date. Traces of the old workings have been almost obliterated, but partially burned limestone marks the old kiln sites. The limestone bodies are small nd are now largely masked by the soil mantle. Chemical analysis of the limestone shows it to be of excellent grade. The Lime Kiln ranch is located three miles west of Highway 49 via dirt road. The turnoff is 5.3 miles north of Higgins Corners and is marked by a white sign (49).

Modern development has obliterated the kilns, but limestone outcrops can still be seen.

13.0 GRANODIORITE INTRUSIVE CONTACT

Three miles beyond the chert reef the greenstone bedrock id invaded by granodiorite. The contact is plainly visible in a roadcut on the west side of the highway. The dark minerals in the granodiorite near the contact have been altered to chlorite and green amphiboles, and the granodiorite is almost as green as the meta-andesite aeries which t invades. A feldspar porphyry is present close to the contact which does not appear to be related to either the meta-volcanic series or the granodiorite, and may have been brought up from below by the intrusion. The porphyry is composed of abundant large plagioclase phenocrysts averaging 3 mm. in diameter set in a fine-grained black groundmass (49).

15.7 LA BARR MEADOWS in granodiorite with manzanita and ponderosa pines.

The change in bedrock from meta-volcanics to granodiorite is almost immediately reflected by the vegetation. Heavy growths of manzanita cover most of the granodiorite bedrock with a dense gray-green mantle. The manzanita thickets are most conspicuous in the vicinity of La Barr meadows.

16.1 Granodiorite in Roadcut.

16.7 Deep weathering profile of granitic rocks.

17.9 Hansen Brothers Gravel Operations.

18.4 GRASS VALLEY CITY LIMIT

Grass Valley is one of the most beautiful historic mining town in the Northern Sierra. Mining camps the world over are notoriously ugly and uncomfortable places to live, but Grass Valley is set in a well watered coniferous forest of great beauty. Many stands of large trees have been spared the loggers axe and tower in dark green borders about broad meadowlands. The entire aspect of suburban Grass Valley is Parklike. Even the mine dumps and buildings are more or less masked by trees so that the scenery suffers little by their presence. The business district of town is much like that of other Sierran towns.

Grass Valley is connected to the overland route through Reno via Highway 20 which joins Highway 40. A railroad once connected Nevada City and Grass Valley to the transcontinental route of the Southern Pacific but the tracks have been removed. Aside form explorations of Spanish Americans of which there is no record, Grass Valley was first visited by French emigrants in 1846. Gold mines form Oregon spent considerable time there in 1848 but the first permanent settlers who were emigrants from the east arrived in 1849. Historical spots in Grass Valley are numerous. The careers of such famous names as Lola Montez and Lotta Crabtree are closely associated with the history of the town. Its lode mines constitute the most productive group of gold properties in California and rank among the richest in the nation.

The geology of the Grass Valley mines differs greatly from that of the Mother Lode mines. Very little large scale faulting is in evidence in the Grass Valley district. The Mariposa slate is largely absent and even Calaveras rocks usually do not contain ore. The main veins dip on an average of 35° whereas most Mother Lode veins are steeply dipping . The minor cross veins are usually not mineralized except at their intersections with main veins. The wall rocks of the Idaho-Maryland and Spring Hill mines are principally gabbro and serpentine; those of the Empire Star and Golden Center are granodiorite, meta-andesite, diabase, and Calaveras schist. Vein forming minerals from the Grass Valley district include ankerite, native arsenic, arsenopyrite, chalcopyrite, chromite, epidote, galena, gold, magnetite, mariposite, pyrite, pyrrhotite, sphalerite, and rarely molybdenite, scheelite, hessite, and altaite. The latter two are tellurides of gold and lead respectively. Wall rocks in the district are heavily workings necessitating use of elaborate pumping systems. Pumps which handle 3000 gallons per minute are used in the wettest spots. Although exceedingly humid, Grass Valley mines are among the coolest in the world. The temperature increase or geothermal gradient below ground is less than 1° F. per 100 feet of depth (49).

19.2 Highway 20 East turn off to West Empire Mine Street.

19.4 West Empire Mine Street. Turn right and go to intersection of South Auburn Street and West Empire Mine Street.

19.5 Empire Mine Park Boundary.

19.7 The Empire Market is on the SW corner of the intersection. Go straight (east) toward the Empire Mine. The rocks in this area are metavolcanics and granodiorite.

20.4. Borne Mansion on the right (south).

20.7 STOP #4B: State Parks Visitors Center EMPIRE MINE STATE PARK

EMPIRE-STAR MINES

The largest mining operation in Grass Valley was that of the Empire-Star Mines Company, Ltd. The Empire-Stare is a consolidation of the major North Star, Pennsylvania, and Empire mines and a host of lesser workings. The Empire began operations in 1851. During World War II most of the shafts have been shut down. The mine workings had gold in them, but they filled with water and have remained so ever since. The workings of the Empire-Star total more than 200 miles in length making it one of the most widespread mines in existence. It has been mined to an inclined depth of more than 11,000 feet or a vertical depth of over a mile. The total production of the Empire-Star group has been in excess of $120,000,000. For the locations of the various shafts of the Empire-Star and other Grass Valley mines see the accompanying map (49).

We will have a guided tour of the Empire Mine and a catered lunch.

Return to Highway 49. Reset odometer

0.0 Highway 49 and West Empire Mine Street. Go straight over the Highway 49 overpass to Mill Street.

0.1 Mill Street turnoff. Take the turnoff and circle back to the right to North Star Powerhouse Road.

0.4 Turn left at Stop Sign to go through Old Town Grass Valley.

GOLDEN CENTER MINE

The Golden Center mine is located in the heart of the business district of Grass Valley. Although the surface extent of the Golden Center property is not great the mine was rich and ore worth more than $2,500,000 was taken from it before litigation forced a shut down. The Golden Center is currently idle. The

deepest shaft is 1900 feet as measure along the incline (49).

SPRING HILL MINE

The Spring Hill mine northeast of Grass Valley is a small but promising operation which was active in 1949. It was one of the neatest, best maintained properties in the gold county and its headframe and mill have been photographed repeatedly for various publications. The main shaft is about 1900 feet deep in diabase and serpentine wall rocks. The recorded production, most of which has been within the last 20 years, is $300,000 (49).

2.0 Downtown Grass Valley. Take Church Street south to Highway 49.

2.5/0.0 Highway 49 onramp. Get on freeway, head north toward Nevada City. Reset odometer.

0.5 Idaho Maryland Road.

IDAHO-MARYLAND MINES

Another major gold-mining operation in Grass Valley active in 1949 was that carried on by the Idaho-Maryland Mines Corporation. Its holdings include the Old Brunswick, New Brunswick, Idaho, and Eureka mines and many smaller workings. The New Brunswick shaft is 3450 feet deep and the Idaho is 2700 feet deep via shaft and winze. A successful attempt at shaft sinking by core drilling was made by the Idaho-Maryland. Part of the core can be seen at the Museum and in downtown Grass Valley. The Idaho No. 2 shaft was sunk 1000 feet into serpentine by this method using a Newsom drilling machine developed at the Idaho-Maryland. The drill cores are five feet in diameter and weigh several tons each. Many of these cores are piled about the entrance to the shaft. Although the Idaho-Maryland is not as large an operation as the Empire-Star, it is still among the six largest gold mines in California, and has a recorded production of $64,240,543. Very complete, up-to-date ore-treatment plants are connected with both Idaho-Maryland and Empire-Star mines (49).

1.6 Brunswick Ave. Exit: TOWN TALK

Midway between Grass Valley and Nevada City was the old mining camp of Town Talk. Little remains to mark the site because it has been overrun by urban development of Grass Valley. Historian Glasscock has it that Town Talk came about partly as an act of God and partly as a practical joke. An old saloon sign bearing the words Town Talk is supposed to have been stranded in the vicinity of the camp by flood waters of Deer Creek. Some wag fished the sign out and stuck it up on the

hill and the camp was thereafter known by that name.

2.8 Gold Flat Road.

3.2 South Yuba Canal Office with display of 5 stamp mill, water wheel and 5-ft diameter drill core of serpentine gabbro. Turn left, go west into Nevada City.

3.3 Downtown Nevada City

NEVADA CITY

Nevada City, four miles northeast of Grass Valley, has been a famous lode-gold mining center although the mines there are currently idle. James Marshall passed through there seeking a placer bonanza in the summer of 1848 but missed making a strike. The first settlers arrived in 1849 and the placers attracted a large population within a few months. Known originally as Coyoteville, because of the local method of tunneling called coyoteing, the name Nevada City was evolved after a dispute with the state of Nevada over priority rights to that name. A total of $8,000,000 in placer gold is said to have taken from the vicinity. Nevada City is county seat of Nevada County and, like Grass Valley, is full of pioneer landmarks such as the Wells-Fargo Express Office site established in 1853, fire-houses built in the 1869's and a remnant of Chinatown. It is situated on Highway 20, which connects with Reno and, like Grass Valley, was once connected to the transcontinental rail route of the Southern Pacific (49).

The Principal lode mines of Nevada City are the Lava Cap, Murchie, Champion, and Providence. The Nevada City assay office is credited with assaying the first ore taken from the Comstock lode (49).

We pass through Nevada City at this time, but will return this evening after visiting Edwards Crossing and Malakoff Diggins.

3.4 Hydraulic workings on Cement Hill Ridge along skyline at 12:00

3.5 Pioneer Park on right.

3.5 Broad Street exit with granodiorite exposed in roadcut

3.6 Street splits at "Y". Stay to the left on Broad Street.

3.8 Nevada City cemetery.

5.0 Hydraulic diggings on right (north) on Cement Ridge.

LAVA CAP MINE

The Lava Cap mine has a recent history dating from 1933. In its ten years of operation it grossed about $12,000,000 in gold and silver! The mine is 2700 feet deep and has over five miles of lateral workings. The Murchie was worked in a small way in the 1890's but major production took place int eh 1930's. The mine is now owned by the Empire Star Mines Company, Ltd., and is currently idle. It was an exceedingly productive mine before the last World War but few figures on it are available. The Champion and Providence mines have been worked discontinuously, with indifferent success, since the early day lode-mining period of the 1860's and 1870's. The Nevada City mines lie at the fringe of the Grass Valley district and the ore shoots have not persisted at depth as have those in the heart of the district.

West from Nevada City, Highway 49 passes through a thick series of tertiary gravels which lie at the southern base of a ridge or rhyolite tuff and andesite. These deposits have been extensively hydraulicked and placered. Hydraulic pits and faces of moderate size can be seen on both sides of the highway. West of the gravels the granodiorite outcrops are full of dark inclusions or enclaves. These vary in size from fractions of an inch to one foot in diameter. Enclaves are common in many granitic batholiths and are formed either by magmatic segregation of various mineral constituents of by inclusion and partial assimilation of wall rocks caught in the invading magma. In most cases they carry a greater proportion of dark minerals than the matrix rock and have a somewhat different pyrite. Pyrite occurs only in the enclaves, not in the matrix rock, and probably was a constituent of the assimilated rock from which the enclaves formed. The texture is granitic but the crystals are finer than those in the matrix rock, which is essentially a biotite-hornblende granodiorite. Excellent exposures of these rocks may be seen in roadcuts 1.2 miles west of Nevada City.

Immediately west of the enclave locality is the contact between the granodiorite and meta-volcanic greenstones. Lindgren's map shows these to be in the Calaveras formation but separate from greenstones lying a quarter of a mile to the west. Two miles farther to the northwest is a narrow belt of serpentine and related basic intrusive rocks which are not particularly well exposed along the highway except in deeply weathered roadcuts. Deeply weathered areas and dark-red soil mark remnants of the old Eocene surface. The remainder of the route into North San Juan lies on a granitic bedrock ranging in composition from quartz diorite to granodiorite. A small roof pendant or remnant of overlying wall rock of dark green amphibolite can be seen in road cuts 1.2 miles south of the Yuba River bridge. The greenstone is cut by aplite and pegmatite dikes. A good locality for collecting hornblende crystals is to be seen close to the amphibolite contact (49).

7.9/0.0 Cement Hill Road and Highway 49. Turn right and go east on Highway 49 past the County Government Center to North Bloomfield Road.

For most of the rest of Day 4, the field trip will depart from the route of the original Highway 49 field guide. Descriptions of the geology and history of Yuba River Bridge on Highway 49 and of Sweetland, Bridgeport and Bitney Corner are found in Appendix IV.

0.4 North Bloomfield Road and Highway 49. Turn left, go north past the California Division of Forestry station.

0.7 Cement Hill Tertiary tributary channel gravels and red soil.

0.9 North Bloomfield and Lake Road "T" shaped intersection. Turn right, go east on North Bloomfield Road.

1.5 Tertiary Mehran Mudflow outcrops on right.

3.2 Normandie Miner to left (north).

4.6 Old narrow concrete bridge.

4.8 Diamond Center Conference Grounds.

4.9 Graniteville Road and North Bloomfield Road. Turn right on Graniteville Road.

6.9 South Yuba Recreational Area.

7.4 Granodiorite exposures.

7.7 Site of historic stage coach robbery.

7.9/0.0 STOP #4C: EDWARDS CROSSING

At this stop it is important that all vehicles park safely to the side of the road. No more than one car at a time should be on the bridge. We will walk down a path for 0.25 miles to a site on the river where there will be a gold panning and suction dredging demonstration.

Enormous amounts of hydraulic tailings were deposited along this stretch of the Yuba river. The tailings extended from this bridge to Malakoff diggings several mines to the east. In some places these tailings were over 150 feet thick and completely choked the river channel. The main southern tributary of the Ancestral Yuba river crosses present canyon of the South Fork of the Yuba river 1 to 2 miles upstream from Edwards Crossing.

After the suction dredging demonstration, we cross the Bridge

and proceed east toward Malakoff Diggins.

1.5 Junction of the Grizzly Hill Road and North Bloomfield Road. Turn right on North Bloomfield Road.

1.7 South Yuba Trail and camp on the right.

2.4 Kenebec Creek

3.9 Lake City Junction. Turn right and continue east on North Bloomfield Road.

4.1 Lake City historic townsite (circa 1860-1880).

4.4 Views of Malakoff Pit at 12:00.

5.3 Malakoff Diggins on left toward the Eastern Channel Deposits. These sand, gravel and clay layers exceed 600 feet in thickness in this area.

5.6 North Bloomfield Drainage Tunnel on left. Humbug Creek on the right.

6.0 Diggins overlook on left (north)

6.2 Crystal Hill Mine on right. This is BLM land and is under claim. You must obtain permission from the mine owner to examine the old hydraulic workings in this area.

6.3 Cemented gravels on the left (north). Sometimes these gravels are cemented by iron oxides, in which case they are called "Ferrocrete". The hardness of these layers make them difficult to mine, even though locally they may contain considerable quantities of gold.

6.5 School house on left.

6.8 Entering Malakoff historic townsite.

NORTH BLOOMFIELD

The immensity of the North Bloomfield pits must be seen to be believed. Although excavated entirely by powerful jets of water, the pits compare favorably in size with many of the open pit copper and iron mines of other states which have been excavated by modern mechanical means (49).

6.9 Malakoff Diggins at Relief Road and North Bloomfield Road.

6.9 STOP #4D: MALAKOFF DIGGINS

The Malakoff pit west of North Bloomfield resembles a miniature Bryce Canyon. The soft clay and gravel walls have been fluted and otherwise sculptured by erosion into "badlands" of great charm. The pastel-colored horizons in the pit gravels contract strikingly with the deep red soil mantle and the dark-green backdrop of forest trees. Some ideas of the achievement of the nineteenth-century hydraulic miners in moving such great quantities of material without modern equipment may be had from the following figures: 20,000,000 cu. yds. were excavated at North Bloomfield; and 25,000,000 cu. yds. from North Columbia. Only 14 percent of the gravel reserves at North Columbia had been removed by the time hydraulic mining was stopped by court injunction in 1884. The problem of the debris from such operations was, of course, a great one. It choked the rivers below and ruined riverbottom lands for farming purposes. In some places the problem has been solved by building debris dams; in others by selective spreading of waste on already valueless areas. A few hydraulic mines such as Relief and Omega situated southeast of North Bloomfield are currently in operation, but most have been idle since the 1880's (49).

We will receive a historical presentation about Malakoff Diggins by the State Parks Department.

6.9 Head out of Malakoff on North Bloomfield Road going east.

7.1 Bair Pond

7.3 Eastern limit of the North Bloomfield townsite.

7.6 Shoot Hill campground to the left.

8.3 Intersection of Derbec Road and North Bloomfield Road. Turn left and go north toward North Columbia.

8.1 Malakoff School on right (east).

8.2 Derbec Meadows on left (west).

9.1 Intersection of Backbone Road and Derbec Road. Turn left and go west on Blackbone Road. Blackbone Road becomes the Graniteville Road, which is paved.

10.0 Intersection of Cruzone Grade Road and Blackbone Road.

12.6 North Columbia Fire Station on right (north).

12.7 North Columbia Store on right (north).

On Day #4 we will go back to Grass Valley after passing through

North Columbia. We will take the Tyler Foote Road west to Highway 49 and then take Highway 49 south to Nevada City and Grass Valley. We end the day at the Grass Valley Best Western Motel.

END OF DAY #4

DAY #5: GRASS VALLEY TO DOWNIEVILLE

This day starts with a Panel Discussion at 8:00 a.m. at the Holbrooke Hotel in Old Town Grass Valley. At. 9:00 a.m. we will resume the field trip by going north on Highway 49 to the Tyler Foote Road and then west to North Columbia.

This field trip will be partly on graded dirt roads between Alleghany and Goodyears Bar. Most vehicles can negotiate these roads, but you must drive slowly and proceed with caution.

0.0 North Columbia Store

0.9 Lake City Road Junction is to the left.

1.4 Tyler Foote Road and Grizzly Hill Road. Turn left and go south on Grizzly Hill Road.

1.4 Entrance to San Juan Ridge Tertiary Auriferous Gravel Deposits. Go through yellow gate into mining area.

1.6 Equipment Yard.

STOP #5A: SAN JUAN RIDGE TERTIARY GRAVELS.

We will get a geology and history presentation from David Lawler at this stop.

After visiting San Juan Ridge we return to North Bloomfield.

0.0 Grizzly Hill Road at entrance to San Juan Ridge hydraulic workings.

0.4 Grizzly Hill Road and Tyler Foote Road. Turn left and return to North Columbia.

0.6 North Columbia townsite. The North Columbia school house on the right is now used as a community hall.

0.7 Jackass Flat Road to left.

1.1 Roadway crosses the northern rim of the Ancestral Yuba River Tertiary Channel. There are extensive hydraulic workings in this area.

1.9 Blue Canyon Formation in roadcuts. These are metasedimentary

rocks.

2.8 Ancestral Yuba River Channel crosses the roadway to the northwest and strikes toward the Badger Hill area.

3.4 Historical site of Cherokee

CHEROKEE, N. COLUMBIA, N. BLOOMFIELD, RELIEF, OMEGA MINES

One mile northwest of Shady Creek bridge a paved road (Tyler Foote Road) intersects Highway 49 which connects with the hydraulic mines of Cherokee, North Columbia, North Bloomfield, Relief, Omega and many others. The Cherokee diggings are six miles northeast of the above intersection, North Columbia, is a little over nine miles, and North Bloomfield is about 19 miles (49).

3.8 Ananda Retreat Center turnoff to the right.

4.2 View of hydraulic tailings on Shady Creek drainage to the left at 10:00

SHADY CREEK BRIDGE

In the vicinity of Shady Creek bridge extensive deposits of Quaternary gravels choke the river bed. These are partly the result of placer operations connected with Tertiary gravels situated upstream (49).

4.5 Granodiorite contact.

5.2 Intersection of Pardon Road, Oak Tree Road and Tyler Foote Road. This place is called "Mother Truckers".

6.3 Eroded granodiorite terrain from this point to Highway 49.

8.5/0.0 Highway 49 and Tyler Foote Road. Turn left and go North San Juan. Reset odometer.

1.0 PETERSON'S CORNER

Peterson's Corner, 1.2 miles northwest of the North Columbia-Highway 49 intersection is the terminus of a paved road connecting with the hydraulic-mining towns of Sweetland, Birchville, French Corral, and Bridgeport. An interesting and a scenic sidetrip on this road will bring one out on Highway 20 at Bitney Corner a few miles west of Nevada City. The route lies principally through granitic basement rocks which have been deeply weathered into a lateritic red clay in many places. An occasional belt of black or green meta-volcanics may be seen bordered on either side by granitic rocks. The many Tertiary gravel deposits lying on this surface are the

basis for the once thriving hydraulic mines (49).

1.9. Hydraulic workings on the left. These are the San Juan segment of the Ancestral Yuba River.

3.3 NORTH SAN JUAN

North San Juan is one of the largest and best preserve of the northern gold towns. The iron grill work on the old brick buildings resembles the grilled balconies of the are Vieux Carre' or French quarter of New Orleans. North San Juan was founded about 1853 not by Spanish Californians, as the name suggests, but by Christian Kientz, an immigrant of German ancestry. He thought the hill resembled another known as San Juan and named the new spot accordingly (49).

NORTH SAN JUAN TO DOWNIEVILLE - GEOLOGIC MAP 9

The topography along Highway 49 north of North San Juan becomes increasingly rugged and more and more typical of the higher Sierra. The northward trend to the highway changes north of Camptonville and the route follows the bottom of the tremendous canyon of the North Fork of the Yuba in a broad northeasterly arc. Remnants of the Eocene surface become more and more restricted in areal extent and are commonly perched well over a thousand feet above present main-stream gradients. Calaveras meta-sediments and thick sections of greenstones reappear south of Camptonville and granitic rocks outcrop in only one area between Camptonville and Downieville. Except for logged-off areas of limited extent in the vicinity of North San Juan and Camptonville, the entire region is heavily forested with coniferous trees. The fauna and flora are typical of the upper transition and lower Canadian life zones. The dominant forest trees are yellow pines and Douglas firs (Oregon pines) with lesser numbers of white firs, incense cedars, and western hemlocks. Alders and other water-loving trees grow along the water courses (49).

From North San Juan to Goodyears Bar this field guide does not follow Highway 49. Along this stretch of Highway 49 are Camptonville, Frog Hollow, Joubert Hydraulic Diggins, Indian Valley Campground and Bald Top Mountain. Geologic and historic descriptions of these areas are found in Appendix V.

3.5 East end of North San Juan.

4.1 Taho National Forest Boundary. Area is underlain by granodiorite.

4.5 Clear Creek Bridge.

6.0/0.0 MIDDLE FORK OF YUBA RIVER AT YUBA COUNTY LINE

Two and eight tenths miles north of North San Juan the highway crosses the Middle Fork of the Yuba at the Yuba County line. The granodiorite near the bridge is prominently jointed into rectangular blocks. One tenth of mile beyond the bridge, a dirt road branches off to the east at an acute angle to the highway recrosses the Yuba over a covered wooden bridge much like the one at Bridgeport. It is covered as a protection against the winter snow pack and the tunnel-like appearance is typical of old mountain bridge in this region. The road connects with the famous mining district of Alleghany, located 24 miles northeast of the turnoff. Alleghany can also be reached via dirt road from Goodyears Bar, a few miles west of Downieville. Lode, drift, and hydraulic mines are located in the vicinity of Alleghany many of which have fine production records (49).

0.1 Turnoff to Covered Bridge on Oregon Creek and day-use area. We will drive through the bridge and then return to Highway 49.

2.1 Turnoff to Alleghany on Ridge Road. Turn right and go east.

2.2 Road to Celestial Valley to the left. We stay on Ridge Road which climbs the west flank of Pliocene Ridge between Celestial Valley and the Forest/Alleghany/Bald Mountain area. There are several high-grade lode and placer properties in the Alleghany Mining District.

4.1 Exposure of slates in the Calaveras Formation.

4.5 Badger Hill hydraulic mines and Tertiary channel on the right (south) across the Middle Fork of the Yuba River. Badger Hill contains the stratigraphically lower (and richer) "Blue Gravels" of the Ancestral Yuba River.

5.3 Gabbro dikes (?) in roadcut on left (north).

5.8 Sierra County line.

6.0 Pike. The historic townsite is to the west of this point.

6.2 Turnoff to historic townsite of Pike.

6.1 Granodiorite

6.6 View of Middle Fork canyon of the Yuba river is to the right (south).

6.9 Metasediments of the Calaveras Group.

7.4 Pliocene Ridge Schoolhouse. Pliocene Ridge is covered with a deep soil mantle and pluvial forest cover.

9.1 Squirrel Creek turnoff to the right.

9.8 Cross section of volcanic channels. This roadcut is a textbook example of this type of feature. The volcanic mudflow cut into and then filled metasedimentary "basement" rocks.

9.9 Back road to Pike on left.

10.0 Turnoff to Tippacanoe and Mount Pleasant hydraulic drift mines on the left (west).

10.3 Plumb Valley baseball diamond. This area was a historic placer and drift mining center.

10.9 Deformed and weathered metavolcanics in roadcuts.

11.6 Tree plantation on Slayville Ridge.

11.7 Mudflows deposited on eroded metasediments on the west (left) side of the roadway.

12.7 Road ascends through lava and volcanic mudflows. These form a cap on a portion of Pliocene Ridge.

14.6 360-degree view of the Sierras.

15.9 Intersection of the Henness Pass Road, Forest and Alleghany roads. There is a historical marker at this junction. We stay to the left (south) and head toward Alleghany.

16.2 Wolzie Flat hydraulic mine across the Middle Fork canyon of the Yuba River is on the right (south). This is the eastern part of the San Juan Ridge portion of the Ancestral Yuba River Channel.

16.2 to 16.8 Intervolcanic channel exposed as cross section in road cut.

17.9 Wet Ravine on the right represents the site of the earliest placer and lode mining activity in the Alleghany District.

18.3 Outskirts of Alleghany.

18.4 Road forks. Turn left (north) to go on upper town road.

18.5 Central Alleghany.

19.0 Turnoff to right. Take this road to double back and go through lower Alleghany.

19.2 Alleghany cemetery.

19.4 Alleghany community park.

19.4 Turnoff to the 16-to-1 mine. This is private property and permission must be obtained prior to going through the gate. Go through the gate and follow the dirt road that leads downhill.

20.0 Outcrops of the Tightner Formation capped by white quartz gravels of the Ancestral Yuba River.

20.1 Fork in road. Stay to the right, go east toward the 16-to-1 mine.

20.2 16-to-1 Mill Building. Kanaka Creek is on the right (south) as is Chips Flat. Remnants of the Tertiary Ancestral Yuba River Channel is exposed on LaFayette Ridge which forms the skyline to the south.

20.2 STOP #5C: ALLEGHANY DISTRICT
16-TO-ONE AND OTHER MINES

The best known lode mines in the Alleghany district are the Sixteen-to-One, Oriental, Plumbago, Rainbow, and Bush Creek, all of which have recorded productions in the millions of dollars. Dozens of smaller workings have been profitable from time to time. The Brush Creek and Yellow Jacket mines were operation early in 1948 as well as the major Sixteen-to-One (49).

The sixteen-to-One, located a short distance downhill toward Kanaka Creek from the town of Alleghany, has been the principal producer of the district. It was discovered in 1876 and, as now operated, is a consolidation of the Twenty-One and Tightner mines and several miscellaneous properties. The main vein system lies along a reverse fault in was rocks of hornblende schist and other metamorphosed sediments of the Tightner and Kanaka members of the Calaveras formation. Serpentine dikes cut the Calaveras and both are cut by the thrust system. Vein minerals from the Sixteen-to-One include arsenopyrite, mariposite, sphalerite, gold, graphite, chalcopyrite, quartz, ankerite, tetrahedrite, galena, pyrrhotite, and pyrite. The deepest part of the mine is 3300 feet form the surface as measured along the inclined Tightner shaft. The total recorded production of the Sixteen-to-One is slightly in excess of $16,100,000 (49).

The mine is now active with a work force of 5 to 10 persons, depending on the time of year.

Hydraulicking in the Alleghany district was confined to a few favorable locations where the gravels were not deeply buried under the Tertiary lava cap. Ferguson has estimated that between two and four million dollars were extracted form the district by hydraulic means. Something is excess of $10,000,000 was produced form drift mines such as the Ruby and about $28,000,000 form lode mines. Placer gravels, principally of Quaternary age added over a million dollars to the above totals, giving a grand total of over $38,000,000 for all gold mines in the district. Ferguson and Gannett give another interesting sidelight on the richness of the Alleghany lodes. They compiled, from various authorities, a table of the probable amounts of gold eroded form the Alleghany lodes and redeposited in channel gravels below. These estimates ranged from $18,000,000 to $52,000,000 (49).

The 16-to-1 mine will also be our lunch stop for the day. We will have an optional Bar-B-Que ($8.00).

After our tour of the mine and mill, we return to the Henness Pass Road Junction.

0.0 Junction of Henness Pass Road and Forest Road. Turn right, go north toward the town of Forest.

0.1 Henness Pass Road is to the east. Keep going north on Forest Road.

0.7 Mud flows are exposed for the next mile on the right (east) side of the roadway. The volcanic cover in the Forest area exceeds 1000 feet in thickness.

1.9 Oregon Creek at historic Forest City townsite. The Bald Mountain drift mine to the north produced over $60 million in gold.

2.0/0.0 Road intersection at Forest. This town retains many historic buildings that are still in residential use.

0.0 Cross Oregon Creek bridge and head west toward Goodyear's Bar.

2.4 Forest City cemetery on right (north).

3.1 Sandusky Creek crossing.

3.3 Unmarked road to the left (south) leads to the Kate Hardy Mine.

3.8 Tightner Formation metasediments.

4.0 Mudflow on right.

4.3 Serpentine on right. This is the same rock unit that hosts the veins at the Kate Hardy mine.

4.8 Ramshorn Fault Zone and Serpentine Belt.

6.1 Road to right is an alternate route to Forest. It is the lower Mountain House Road.

6.2 STOP #5C: VIEW OF RAMSHORN FAULT ZONE IN WOODRUFF CREEK AND GOODYEARS CREEK.

The Ramshorn Fault is a major structural suture zone extending for 10 miles north and 4 miles south of this point. It is a highly mineralized zone and contains rich lode gold deposits (e.g. Brush Creek Mine). There are also several rich placer deposits in this area: the Magnolia, Newkirk and Colony mines. The fault zone follows both Woodruff Creek and Goodyears Creek. These are south and north of the North Fork Yuba river respectively. The Yuba river cuts across the Ramshorn Fault Zone at a 90-degree angle.

Ramshorn Fault zone has created a broad valley over one mile wide.

Fir Cap Peak is at the head of Goodyears Bar to the north.

6.3 Road to left at Mountain House Junction goes to Pioneer Dark graveyard. This is the Slaysville Ridge Road.

7.0 Road descends to Woodruff Creek.

7.2 Gate for upper Brush Creek Mine and Mill site.

9.8 View of Grizzly Peak at 12:00.

9.9 Rock Creek is to the right. This is a tributary to Woodruff Creek and is rich in modern placer deposits that have formed from modern rivers cutting through and enriching older Ancestral Yuba River gravels.

10.3 Serpentine of the Ramshorn Fault Zone.

11.2 Junction with the lower Brush Creek Mine Road to the right.

11.4 Road parallels Woodruff Creek. There has been a small amount of historic placer production from this area.

11.7 Woodruff Creek Bridge.

11.9 Historic townsite of Goodyears Bar.

GOODYEARS BAR

Goodyears Bar, located near the junction of Woodruff and Goodyear Creeks with the Yuba four miles west of Downieville, was settled in the summer of 1849. It prospered during the 1850's before its rich placers were exhausted, but a fire which virtually destroyed the town in 1864 culminated a steady decline which had begun some years earlier. A good dirt goad from the Alleghany mining district joins highway 49 in the vicinity of Goodyears Bar (49).

RUBY DRIFT MINE

The Ruby drift mine is below the Ruby Bluff near the headwaters of a north-south trending tributary to Rock Creek, southeast from Goodyear's Bar. It is famous for its coarse gold nuggets and its large quartz crystals. It is one of but few mines in the district which are still operating. The workings are principally tunnels in the bedrock from which raises are put up to the channel gravels above. There are several miles of tunnels and drifts and several vertical access and escapeway shafts. Ore is hauled out along the main tunnel level and run through sluices. More than 123 nuggets valued at over $100.00 each had been removed from the Ruby by 1941. The largest weighed 52.3 ounces and was worth $1,758.00 (49).

12.0 Stop sign. Turn left.

12.1 Cross North Fork of the Yuba River. Terrace gravels can be seen at the west end of the bridge.

12.2/0.0 Junction of Highway 49 and Mountain House Road. Turn right on Highway 49 and go east toward Downieville.

0.1 Cross section of Ramshorn Fault Zone metasediments.

Three-tenths of a mile east of Goodyears Bar is a prominent outcropping of serpentine which is associated with fine-grained dark intrusive rocks. Half a mile east of the serpentine belt is a small area of meta-gabbro. The fine-grained basic rocks are cut by quartz veins (49).

A broad zone of faulting and deformation is visible along the highway 1.4 miles west of Downieville. The meta-volcanics there are much contorted and, in many places, are impregnated with pyrite. In the stream bed below, deep circular depressions known as potholes or kettles spinning action of rapid water over uneven, bare rock. Gravel and pebbles caught in the depressions are spun by the currents and aid in the circular downcutting effect. They are a common feature along streams of considerable gradient (49).

0.2 Serpentine.

0.8 Metavolcanics of the "Yuba Terrain" are part of the Calaveras Group of rocks outcrop for the next 3 miles.

2.3 Rosassco Ravine to the left (north).

2.4 Old Toll House Road crossing is on the right (south).

3.0 Coyoteville historic site. This is now a resort.

3.4 Slug Canyon on right (south).

3.6 Turnout to right at Canon Point. Overview of Downieville.

3.8/0.0 DOWNIEVILLE

Downieville, county seat of Sierra County, is situated at the junction of the north and east branches of the North Fork of the Yuba River. Lofty tree-covered mountains surround it on all sides and it is a fitting location for the center of a well named county. There is very little flat land in the county and this is located either along river bottoms or on upland remnants of the Eocene surface. Like Goodyears Bar, Downieville was found in 1849 by a party of gold seekers. Originally known as The Forks, the name was changed to Downieville in honor of William Downie, one of the initial settlers. More than 5000 people jammed the town in 1851 and some rich strikes were made. So determined were the miners to get the gold from the bed of the Yuba that they flumed and diverted the river from its bed between Downieville and Goodyears Bar. This worked beautifully as long as summer held out, but winter floods quickly wiped out the project. After the placer mines were exhausted, gold mining went on in hydraulic, drift and a few lode mines. The town is now supported by lumber and mining interests and by Forest Service and other government personnel. Very few historical buildings remain, the County Courthouse and St. Charles Hotel having burned in 1947. The Pioneer Museum, a well-built stone building with iron doors and window shutters, was restored by the heirs of pioneer J.M.B. Meroux and dedicated to the Pioneers of Sierra County by the Native Sons and Daughters of the Golden West in 1932. Costa's grocery store, also of stone, dates from 1852 (49).

6.3 CAMP YUBA

Camp Yuba, 5.4 miles east of Downieville, is another of the very fine public camps situated on the banks of the river. This camp is near the old placer camp site of China Flat. Several lode gold mines are located both to the northeast and southeast of Camp Yuba and the Ladies Canyon bridge include a small body of weathered granodiorite which looks as if pre-existing wall rocks had been assimilated by it. It is a dark, impure rock resembling a granite in texture only. Excellent examples of hill creep or false folding in platy meta-sediments may be seen along the roadside in several places. Hill creep is produced on steep slopes by gravitational bending of inclined strata in a downhill direction and is usually the result of downhill movement of the soil mantle which lies above the titled edges of the stratified bedrock (49).

7.8 Road to Gold Point Road is on the left (north).

8.0 LADIES CANYON Creek with rich placers upstream.

Between Ladies Canyon and Sierra City a wide variety of interbedded meta-sediments, meta-volcanics and dike-like intrusives are exposed in the many roadcuts. Slate, phyllite, schist, chert, quartz porphyry, serpentine, and green meta-volcanics can all be collected at various places along the highway. Terrace alluvium perched high above the present stream channel may be seen in the vicinity of Fournier Ranch and Loganville (49).

8.4 Negro Canyon on right (south). The Cleveland mine is on the east side of Negro Canyon.

8.8 Small turnout with placer workings to the right (south) on the south side of the North Fork of the Yuba River.

9.2 Fournier Ranch. Over the past few years, placer operations at Fournier Ranch have produced up to 100 ounces of gold a week for several seasons. Al Dupree was the operator.

10.3 Keystone Mountain on right (south).

11.0 View of Keystone Mine on the right (south). The lower portion of the canyon is not visible from this point and is the location of the Lucky Boy Mine.

11.1 Loganville (Shanon's Cabins). Northwest of Loganville are the Primrose, Buffalo, Monarch, Sovereign, and Columbo mines.

11.7 Forest Service campground.

12.1 4,000 ft elevation sign.

12.6 Metavolcanics and metasediments are exposed in roadcut.

12.8 West end of Sierra City

13.3 Sierra Buttes to the left (north)

13.4/0.0 East end of Sierra City.

SIERRA CITY

At the edge of Sierra City, a road leads off to the north which connects with Sierra Buttes mining district. As mentioned in preceding paragraphs, the Sierra Buttes district is noted for the many large nuggets recovered there in early days. There is little or no activity in the district at present. The columnarly jointed lava cap of Sierra Buttes can be seen in many places along the highway in the vicinity of Sierra City (49).

Sierra City, located at the foot of towering peaks on a narrow river terrace, was first settled in 850 by gold miners. The vicinity was full of Indian racherias or camp sites and apparently was one of the most heavily populated Indian districts in California. The new settlement was destroyed by an avalanche in 1852 and the present buildings date from the 1860's or later. The main street of Sierra City resembles those of many other towns of the gold country. The brick-and-frame Busch Building has the same iron doors and shutters that are so typical of fire-conscious towns built in the 60's and 70's. Sierra City is famous for being the birthplace of a roisterous society known as E. Clampus Vitus. The organization has the reputation of being principally a perpetrator of practical jokes upon the uninitiated. At any rate, name and reputation are colorfully connected with the history of Sierran gold mining from Sierra City far down the Mother Lode. The society was reorganized several years ago by the California Historical Society, apparently with satisfactory results to all concerned (49).

0.3 Wild Plum Road to right (south).

0.7 View of Haypress Canyon.

0.9 Turnoff to Kentucky Mine Museum on left. Take this road to the next stop

STOP #6B: KENTUCKY MINE AND MUSEUM

We will receive a guided tour through the museum and mine. Entrance fee is $4.00.

After our tour of the Kentucky Mine we return to Highway 49.

0.0 Kentucky Mine Turnoff

0.8 GLACIAL DEBRIS resting on metavolcanics.

East of Sierra City, Highway 49 passes close beside an east-west contact between the quartz-porphyry bedrock and overlying glacial moraine detritus. This is the first appearance of glacial debris along Highway 49 but morainal deposits can be seen in a great many places between Sierra City and Bassett at the foot of Yuba Pass. The most obvious characteristic of the glacial deposits is their extreme variability or heterogeneity. Clays, gravel, and huge boulders both stratified and unstratified are dumped together in irregularly shaped deposits. Some of the fragments or clasts have been planed off or faceted by the ice. Others have been grooved or striated by being ground against resistant bedrock. Most of the boulders and smaller stones are merely rounded or subangular and one must examine many of them to find any which have characteristic glacial markings. The quartz porphyry east of Sierra City is a light-buff rock with a very fine-grained groundmass and numerous small, rounded, quartz crystals or phenocrysts and less numerous rectangular or lath-shaped feldspar phenocrysts. The rock is probably close to a dacite in over-all composition. East of the quartz porphyry belt of green porphyritic meta-andesite breccia much like the Logtown Ridge formation along the Mother Lode.

1.4 to 1.7 Reworked glacial material.

1.9 Springs on hillside to the left.

2.3 Basalt flows and talus slopes to the right.

2.5 Salmon Creek bridge.

2.6 Folded bedded cherts of the Elwell Formation.

2.9 Glacial moraine (reworked) with talus.

3.9 Bassett townsite at Howard Creek.

3.9 BASSETT

From the vicinity of Bassett to the summit of the pass, the basement rocks are weathered granodiorites of the main pluton or batholith which forms the core of the Sierras. Spheroidal decay boulders can be seen weathering out of the main granitic mass in many places. Preservation of more or less unaltered spheroids in an almost completely weathered matrix is typical

of granitic masses in a great many other places as well as the Sierras, and is t phenomenon which has never been adequately explained. Local differences in grain size and mineral composition sometimes account for it. In other instances the effect has no apparent local control (49).

The main rock type between Bassett and Sattley is granodiorite.

4.3 Intersection of Highway 49 and Sardine Pond road.

5.0 San Francisco State University Field Camp to right.

GOLD LAKE AND SARDINE CAMPGROUND

A road connecting with Gold Lake, Sardine Creek public camp and other parts of the Plumas National Forest joins Highway 49 4.3 miles northeast of Sierra City. Sardine Lake and others in the vicinity are cirque lakes of glacial origin. Except for the moraines to be seen along the North Fork of the Yuba, glacial features are few along Highway 49 and it is necessary to take side trips in order to see examples of glacial topography. A road passable in summer connects with the glacial Packer Lake and resorts. Sardine Lake must be reached by foot from Sardine Creek public camp (49).

6.2 Haskell Creek bridge.

7.0 Chapman Creek campground.

8.9 Yuba Fire Camp at right.

10.7 YUBA PASS

The summit of Yuba Pass, at an elevation of 6701 feet, lies in a broad, upland valley which is slowly being dissected at either end by streams of opposing watersheds. The California Sno-Park Camp is to the right (south). The winding grade from Yuba Pass to Sattley affords fine views of Sierra Valley which opens out to the northeast from the vicinity of Sierraville. Sierra Valley is a graben or depressed fault block part of which has been masked by volcanic mountains extruded since the depression of the block. Subsequent erosion and glaciation has greatly dissected the disrupting lave. William Morris Davis believed Sierra Valley to be a continuation of the graben which is partly occupied by Lake Tahoe. The Fault which roughly corresponds with the western edge of the valley crosses Highway 49 immediately west of Sattley. Andesitic gravels can be seen faulted against the granodiorite in places where the contact is not masked by alluvium (49).

13.4 View of Sierra Valley to the east.

13.8 Leaving Taho National Forest.

14.8 Vista Point on right has a small but informative display about the geology of this area. This will be an optional stop.

14.9 Volcanic ash on left.

15.1 Chapman Saddle Road on left.

16.9 Junction of Highway 89 and 49.

17.2 Enter Sierra Valley floor.

17.8 SATTLEY

Highway 49 joins Highway 89 at Sattley, Sierra County, thus terminating 277 miles of mountain road which began at the Highway 49-Highway 120 road junction at Mariposa in Mariposa County. Virtually the entire stretch lies in gold mining country within the Sierra Nevada. Few routes through California are as replete with historical color as this Golden Highway (49).

This marks the end of this field guide, but not of our field trip. We continue on to Truckee and Donner Pass. Most of us will spend the night in Auburn.

END OF DAY 6

END OF FIELD CONFERENCE

APPENDIX I

TUTTLETOWN

After leaving the vicinity of Columbia, Highway 49 bends around the northern end of Table Mountain and follows along its western base for about tow miles before turning west into Tuttletown. Some of the gravels in the creek beds of this vicinity are being worked for gold by small dragline dredges. Tuttletown, located seven miles from Sonora via Highway 49, was first settled by Mormons in 1848, and was originally called Mormon Camp. James M. Tuttle, whose name the town now bears, arrived considerably later than the first Mormons. A fairly well preserved stone structure dating from 1852 is one of the few relies remaining in old Tuttletown. Division of Highways Historical Marker 124 is located near this spot.

ARBONA MINE

The headframe and red sheet iron buildings of the Arbona mine are located close to the highway near the center of Tuttletown. The mine has a 600-foot inclined shaft in schist country rock. Production from this mine has not been extensive and there has been no major exploitation since 1909. Some pocket gold was recovered from it during the early thirties.

JACKASS HILL (CHILENO GROUP)

State Division of Highways Historical Marker 138, one mile from Tuttletown, is close tot he turnoff to Jackass Hill. Jackass Hill was once famous for its "pocket" gold mines and has since been made a shrine to the memory of Mark Twain who stayed there with the Gillis Brothers for an indefinite period. The present Mark Twain cabin is a reconstructed replica of old cabins in the area and is not the original gillis cabin. No production figure is available for the mines on Jackass Hill, known generally as the Chileno group, but some of the pockets were exceedingly rich. The gold occurs in quartz and carbonate stringers cutting Calaveras schist. The Jackass Hill mines produced beautifully crystallized specimens of gold as well as the gold tellurides petzite and calaverite.

A mile and a half northwest of the Mark Twain historical marker, the mine dumps and building foundations of the Norwegian mine can northwest slope of Jackass Hill although it is some distance from the pocket mines near the Mark Twain cabin. This mine has been worked discontinuously in a small way since 1851, but is now idle. The ore was in pockets and ore minerals included gold, pyrite,chalcopyrite, galena, petzie, and small quantities of others tellurides. The total recorded production is only $131,000 but considerably more was undoubtedly produced of which there is no record.

NORWEGIAN MINE

The Norwegian mine is of interest principally because the notorious outlaw Black Bart was caught as a result of a fracas involving a stage carrying Norwegian mine gold. Bart is supposed to have dropped during the holdup the handkerchief by which he was traced to his lair in San Francisco.

STANISLAUS RIVER: ROBINSON'S FERRY

Beyond the Norwegian mine, Highway 49 drops into the canyon of the Stanislaus River, and crosses the latter at Robinsons Ferry, immediately south of the town of Melones. During high water, the canyon bottom is flooded by the lake which backs up behind the Melones Dam,located more than seven miles downstream. The most recent highwater mark can be seen on the canyon walls as a line of dirt and debris. The bridge at Robinsons Ferry is at the Tuolumne-Calaveras County line, a line which follows the course of the Stanislaus in this area.

MELONES-CARSON HILL

Melones, situated on the north bank of the river, would be a very scenic spot were it not for the shambles of shacks and worn out mining equipment which clutter the hillside behind the town. The large 100 stamp mill and some other buildings burned in 1942 and the mine premises have badly deteriorated since them, The Melones-Carson Hill mining district has one of the most colorful histories of any along the Mother Lode and mining on Carson Hill has for the most part been a very lucrative enterprise. Although early records are incomplete. Carson Hill mines are credited with a production of more than $26,000,000. Spanish American miners found placer gold along the Stanislaus and its tributaries early in 1848. They are responsible for the name Melones, which was applied to the area because of the placer gold which resembled melon seeds. In 1850, two years after the Spanish Americans located the town of Melones, James Carson and John Hance were diggings placer gold from Carson Creek. Hance is credited with the initial lode-gold discovery on Carson Hill when he followed placer gold showings uphill to their source near the massive quartz outcroppings. The Billy Mulligan gang jumped the claims and held them for nine months before being thrown off the property by court order in 1853. Little more than a year later, the largest mass of gold ever produced in California and one of the largest on record was taken from Carson Hill. It weighed 195 pounds troy which, calculated at present prices and 900 fineness, would be worth $43,534. Presence of this huge mass of gold brought business to Robinsons Ferry to the tune of $10,000 in tolls in less than six weeks!

CARSON HILL

The mines of Carson Hill are famous for the telluride minerals produced in quantity during the early decades of operation. Calaverite, hessite, petzite, and sylvanite were common minerals in Carson Hill. Melonite, a telluride of nickel, is a very rare mineral named after the town of Melones and is found in but few other parts of the world.

Two large surface working or glory holes can be seen on Carson Hill. One is on the southwest flank of the hill 1.5 miles from Melones. This is the Calaveras cut on the Santa Cruz claim. The larger of the tow is located on the north side of the hill about a mile south of the town of Carson Hill. This is the Morgan stope on the Morgan claim. The Morgan stope was exploited partly by steam shovels from the surface but most of the ore was taken out through tunnels from below. The Melones tunnel, the adit of which is close to Highway 49 just north of Melones, was the main ore-removal way from the Morgan claim. Some idea of the magnitude of the Carson Hill workings may be drawn from the Tremendous size of the tailings dump to the east of Melones.

North from Melones, Highway 49 rises abruptly along the flanks of Carson Hill. There are 3.5 miles of narrow switchbacks and sinuous mountain driving between melones and the town of Carson Hill. The road cuts on Carson Hill expose a great many quartz-carbonate stringers or veinlets which are typical of the Mother Lode mineralization on its eastern spur from Jackass Hill to Angels Camp. The main thrust fault of the Mother Lode system lies considerably to the west and was not mineralized along this sector. North from Carson Hill the route lies in rolling country which has been exploited both by placering and lode mining. Evidences of both are to be seen everywhere. Carson Flat, Frogtown, and Albany Flat were early day gold camps though little now remains at the old site which lay close to present day Highway 49. The Mother Lode Central, Marble Spring. Harris, and Waterman mines are all located closed tot he highway on its west side between Carson Hill and Angles Camps. None of them has been particularly productive as compared with Carson Hill or the mine of Angels camp. See the map which accompanies this chapter for more precise locations on these mine.

APPENDIX II

MURPHY'S GRADE LOOP AND CALAVERAS CENTRAL AND OTHER MINES

CALAVERAS CENTRAL AND OTHER MINES

The Calaveras Central, Slab Ranch, Golden River, and Vallecito Western are some of the mines located in this region, all of which entered the Central Hill gravel channel at different places on its course. This fossil stream channel lies buried about three hundred feet beneath the surface and its filled with gravel and volcanic ash. The Calaveras Central mine was being rehabilitated early in 1948, but is now closed. Its workings are very extensive and reach the buried lies upon this coarse gravel. Rhyolitic lake bed ash containing fossil leaves lies upon this coarse gravel. Above this and filled to the surface is volcanic ash and stream gravel of all sorts.

These mines are located between Highway 4, running east from Angels Camp, and the Murphys Grade road which runs east from Altaville. the sidetrip from Altaville to Murphys and back to Angels Camp is one which no visitor to this part of the gold country should miss (49)

MURPHYS GRADE LOOP side trip: Altaville to Murphys Grade and Back to Angel's Camp.

0.0 Murphy's grade Road and Highway 49. Turn right (east).

0.5 Valley Spring Formation at 1:00 above Tertiary gravels and metavolcanic rocks.

2.2 Turn off to Calaveras Central Mine and North side of Bald Hill

3.4 Utica Pitch (Flume) on left (west). This flume has a long history of litigation regarding water rights.

Traveling east from Altaville the quarried outcrops of grayish-tan rhyolite tuff of the Valley Springs formation can be seen in rounded hills above a surface of lesser relief. The tuff overlies the gravel channels in many planes and it is beneath this material that the drift mines have been driven. The tuff has been extensively quarried for use as a building stone because of its accessibility, durability, and workable properties.

The Calaveras Central mine is located on the north side of Bald Hill the turnoff to which is six-tenths of a mile east of Altaville. As seen from the south, the name Bald Hill is a

misnomer, that side of the hill being brushed over. Bald Hill is the site of the famous "Calaveras Skull" hoax, perpetrated on geologist J.C. Whitney and others in the 1860's in which an Indian skull was placed as a practical joke at eh bottom of a shaft which was sunk in the Tertiary steam gravels. A few miles beyond Bald Hill the road locally known as Murphys Grade begins a gradual ascent up the park-like canyon of angels Creek to Murphys, probably the best preserved and most beautiful of the old towns which date from the gold rush. Very little modernization has been done there. Looking down its main street with its fine old buildings and overhanging trees is like turning back the pages of history nearly a hundred years. Murphys is the starting place for Mercers Cave, a limestone, cavern privately owned but open to the public, the Sheep Ranch mining district, Murphys mining district, and the high Sierra of Ebbetts Pass (49).

The lode mines of the murphys district, located on Highway 4 a few miles northeast of the town of Murphys, differ from most other gold deposits in the vicinity of the Mother Lode in that the veinlets of meta-clastics. The mines were discovered in 1848 but were never sensational producers (49).

4.5 Murphy's Grade up Angel's Creek

4.7 Murphy's Ghost town

6.7 Mercer's Care turn off

6.8 Murphy's historical Marker #139

7.2 Intersection Murphy's Grade and Highway 4. Turn right on Highway 4 toward Angel's Camp.

8.0 DOUGLAS FLAT Hydraulic Diggings

Doubling back on Highway 4 toward Angels Camp, the hydraulic diggings of Douglas Flat are evident to the northwest of the road. This is one of the most southerly of a great series of immense hydraulic diggings which are scattered from Calaveras to southern Plumas County. Above the face of the Douglas Flat pit it a black lava-breccia cap the edges of which are fluted by weathering, but have the false appearance of columns, jointing which is characteristic of the solid lave of Table Mountain latite. The latite flow is located to the east (49).

8.0 Turn off to Modern Gravel pit turn left (east).

0.0 Return to Highway 4.

0.3 Pseudo-columnar jointing.

0.7 Holiday Mine Road in Calaveras Group limestone.

1.5 Workings to right (north).

1.7 MOANING CAVE to left (south).

Moaning Cave, a limestone cavern privately owned but open to the public, is located on the opposite side of Coyote Creek canyon and may be seen from the road. It is also two miles from the junction in Vallecito.

11.0 Parrot Ferry road to Columbia in granitic Rocks.

11.3 Vallecito

12.4 Ridge of volcanics to right (North)

13.3 Six Mile Road

13.7 Roadcut in Tuff of Valley Springs Formation

15.1 Golden River Vallecito Western and Slab Ranch Mines to right (north).

GOLDEN RIVER, VALLECITO WESTERN AND SLAB RANCH MINES

As one travels west into Angels on Highway 4 the head frames of the Golden River, Vallecito Western, and Slab Ranch mines ar seen to the north of Highway 4. These drift mines are now all idle and filled with water. Though the geology of the Tertiary Channel may be part of the same stream system as the Columbia River Channel which was bisected by the Stanislaus River (49).

GOLD HILL-WAGON RUT MINES

Two mining districts of considerable interest lie to the west of Altaville along Highway 4. Dumps and prospect holes of the Gold Hill pocket mining district can be seen a short distance to the north of the road.

The Wagon Rut mine was the best known of the Gold Hill mines. The headframe of the Belmont-Osborne mine is situated half a mile southwest of the Gold Hill group and can also be seen from the road.

APPENDIX III

SIDE TRIP: PLACERVILLE TO COOL VIA GARDEN VALLEY

The route from Placerville to Cool via Garden Valley, Georgetown, and Greenwood is in most respects superior to that traversed by Highway 49 and might well be named an alternate to that highway. The Georgetown turnoff is eight-tenths of a mile from the center of Placerville and is a well paved, well marked road. the first three miles toward heavily timbered with incense cedar, Douglas spruce, and yellow pine. With the exception of a narrow belt of greenstone and an occasional serpentine intrusion, the basement rocks along this road from Placerville to Georgetown are Jurassic meta-sediments, chiefly Mariposa slate. The Pacific Mineral fragments which are used as a wearing surface on asphalt-felt roofing.

Half a mile from the American River bridge, the road winds up the narrow Kelsey grade which climbs from the bottom of the American River canyon 1100 feet tot eh upland around Kelsey. Deeply weathered remnants of the old Eocene surface abound in the Kelsey-Georgetown area. Brilliant red soil and lateritic clays are exposed everywhere and much of the present land surface is a resurrection of that which existed at the beginning of the Tertiary period. Some of the gravel remnants which lay on this surface proved to be rich in gold. Kelseys Ravine at the present site of Kelsey was one of these.

KELSEY

Kelsey was founded in 1851. James Marshall's last days were spent there. A building on the property of his Gray Eagle mine once housed a pioneer museum but the exhibits have been move to Columbia and other places. Only a huge arrastre-stone remains of the old exhibits once displayed there. The adit of the Gray Eagle lode mine is immediately behind the museum building. It never paid, and Marshall died without ever having a hand in a really successful mining venture.

SPANISH FLAT, MEADOWBROOK AND GEORGETOWN

North of Kelsey, distance of 1.4 miles, a road leads off to the east through Spanish Flat and Meadowbrook, ending at Georgetown. Spanish Flat, more recently known as Louisville, was one of a great many placer camps of the vicinity dating from about 1850. The Alhambra and Lost Lode mines are located close to the Louisville road. They are shallow open cut and tunnel workings in stringer lodes. Both are idle.

GARDEN VALLEY

Garden Valley, originally named Johntown, is 5.5 miles northwest of Kelsey. Johntown was a placer camp which later became a vegetable growing center, hence the present name. The entire area in which Garden Valley, Spanish Flat, Georgetown, and Greenwood are located is one of the most beautiful landscapes in California and is bound to find increasing favor as a recreational region. The broad rolling meadowlands are bordered by flowing streams and beautiful stands of coniferous trees. The primitive area of the Rubicon River northeast of Georgetown is almost untouched by the inroads of Man.

BLACK OAK MINE

Half a mile beyond Garden Valley, a road to Meadowbrook leads past the Black Oak mine near the Garden Valley school. The Black Oak has been one of the best mines in El Dorado County, having produced over a million dollars in gold. The veins are on the contact of Mariposa slate and greenstone and are the same series as in the Alpine and Beebe mines to the north in Georgetown. The workings are rather shallow but the drifts and crosscuts are extensive.

GEORGETOWN

Georgetown, 7.3 miles from Garden valley, looks much as it did in the '50's. Mining activity there was initiated in 1849 by a party of placer miners from Oregon, and the site was first known as Growlersburg. Several lode mines helped keep the town active after the placers were exhausted. Lumbering and fruit-growing are now the principal activities. The main street has many well preserved buildings such as the Masonic Hall erected in 1852 and the Balsar House dating from 1859. Edwin Markham taught school in Georgetown in the 1880's. Like those of many other Mother Lode towns, Georgetown's pioneer rallied to the Union side during the Civil War. An armory was built in 1862 which is still standing. The El Dorado County Chamber of Commerce has erected suitable historical markers at sites of special interest. The Alpine at the center of town and the Beebe at the northern edge are the best known of the Georgetown mines. The Alpine was first developed in the 1860's and was extensively worked during the 1930's. The Beebe is largely a twentieth-century development. Both produced occasional bonanza pay streaks but gold values were spotty. The Alpine shaft is less than 500 feet deep; the Beebe has a large open cut and a 500-feet shaft.

GREENWOOD

Five and one-half miles west of Georgetown is the crossroads hamlet of Greenwood which once boasted several wineries and was supply center for many adjacent placer districts. A large lumber yard is the principal activity there now. Numerous placer and hydraulic

diggings can be seen along the greenstone of uncertain age but there are few good exposures because of the deeply weathered nature of the bedrock and the soil mantle. The road is bordered by rank growths of yellow-flowering Spanish broom, an introduced plant.

GREENS MILL JUNCTION

A mile north of Greenwood at the Greens Mill junction, are good exposures of well bedded Mariposa slate. The relation of the bedding to the slaty cleavage can easily been there. A number of small folds within the Mariposa are evident in the road cuts along the Greens Mill road.

SPANISH DRY DIGGINS

Less than half a mile from Green Mill junction, a paved road turns off to the north which leads to Spanish dry Diggin's and ultimately to other old camps ont eh North Fork of the American River. Spanish Dry Diggin's was discovered by a group of Spaniards under General Pico in 1848. The placer mines were soon superseded by the "seam" or stringerload mines such as the Grit or Littycote mine. The Grit had an early production of over $500,000 and the Barr over $300,000. A mass of gold weighing 101 troy ounces was taken from the Grit mine in August 1865. This was donated to the museum of the State Division of Mines in honor of Jules Fricot by his heir Mrs. Marie Fricot Berton and is now on exhibition in the Ferry Building, San Francisco.

One mile beyond the Greens Mill road junction is a fault contact between Calaveras rocks and serpentine. The Calaveras there is composed of mica schist, chert and basic intrusive such as basalt. Another small body of serpentine occurs at the Penobscot farm 1.3 miles farther west. From the Penobscot farm west to Cool the basement rocks are mainly Calaveras schist, chert, and meta-basalt and greenstones of doubtful age. These are intruded locally by small bodies of serpentine. The Penobscot farm is a picturesque, well kept property surrounded by orchards and grazing land and is the principal landmark between Greenwood and Cool.

APPENDIX IV

GEOLOGY AND HISTORY ALONG HIGHWAY 49 BETWEEN NEVADA CITY AND NORTH SAN JUAN.

YUBA RIVER BRIDGE ON HIGHWAY 49

Close to the south abutment of the Yuba River bridge, a broad roadcut and quarry in granodiorite afford an excellent close-up view of the intruding batholith. The coarse matrix is full of large inclusions or enclaves and several prominent joint systems prevail which have aided in quarrying the rock for fill. The river water is often discolored by tailings from hydraulic workings upstream.

The road cuts up the grade along the north wall of the Yuba River canyon expose granitic rocks of at least two separate intrusive bodies. Contacts between the intrusions are indistinct, granodiorite grading into darker hornblende diorite which is cut by light-colored dikes of variable texture.

SWEETLAND

Sweetland, of which Peterson's Corner is a part, was originally a placer-mining camp first settled in the early 1850's. Together with adjoining towns to the southwest, Sweetland was a going and prosperous town of the region. Sweetland is now a handful of frame swellings set in a quiet country landscape. Birchville, 1.5 miles southwest of Sweetland, is located principally by the hydraulic pits to the north of the old town site. Several are filled with water and form small lakes.

Three miles below Birchville is French Corral which dates form 1849. The town is located in an attractive valley on a tributary to the South Fork of the Yuba River. Several well preserved stone and brick buildings remain along the main street. French corral wa at one end of the first long distance telephone line ever built. It connected with Birchville, Sweetland, North San Juan, Cherokee, North Columbia, North Bloomfield and Bowman or French Lake, a distance of 58 miles.

BRIDGEPORT AND BITNEY CORNER

Very little remains at the Yuba River site of Bridgeport, three miles southwest of French Coral. A covered wooden bridge spans the river and grown graveyard is located beside the road a short distance south of the river. There is little of particular geologic or historical interest between Bridgeport and Bitney Corner on Highway 20, but the landscape is an attractive one and the side route will draw travelers who like to keep off the beaten track.

North along Highway 49 from Peterson's Corner, remnants of the exhumed Eocene surface are evident in several places. This flat surface is particularly noticeable in the vicinity of North San Juan. Large hydraulic diggings can be seen to the west. The granitic basement rocks are a dark or melanistic phase of the ordinarily light-colored granodiorite, being rich in biotite mica.

APPENDIX V

POINTS OF INTEREST BETWEEN NORTH SAN JUAN AND GOODYEARS BAR

CAMPTONVILLE

The placer and hydraulic town of Camptonville is located half a mile off Highway 49, 8.4 miles northeast of North San Juan. Camptonville was founded about 1850 as a hostelry on the Nevada City-Downieville road. The town boomed as the result of local gold discoveries in 1852. Few present-day buildings date back to gold rush days as the town was destroyed several times by fire. However, a quasi-colonial type of architecture prevails among the older frame buildings and the large frame hotel is a delightful spot shaded by large trees. Red, pock-marked, Eocene gravels outcrop on the hills to the northeast of town much as the gold diggers left them (49).

Half a mile below the Camptonville turnoff, a group of pegmatite and aplite dikes stand out of the deeply weathered bedrock. The light colored minerals of the dikes show little evidence of weathering whereas the biotite-rich matrix is decomposed. Half a mile above the Camptonville road deeply weathered cleavable meta-volcanics can be seen lying below the deep red soil mantle and below Tertiary gravel deposits. The meta-volcanics are so decomposed that they disintegrate when tapped with a hammer. Few places so clearly illustrate the relationship between the deeply weathered rocks of the Eocene surface, the Eocene channel gravels, and the present-day land surface. The road cuts are also an excellent study in direct formation of soil mantle from parent bedrock lying immediately below (49).

Between Camptonville and the Frog Hollow public camp, several small bodies of deeply weathered granite rock outcrop along the roadside. These approximate a gabbro in composition and were apparently too small to be mapped by the early members of the Geological Survey. They mapped this entire area as amphibolite but this designation covers a wide variety of rock types including fine grained basic and intermediate intrusives, green meta-volcanics, mica schist, and the aforementioned gabbro (49).

FROG HOLLOW

Frog Hollow, three miles north of Camptonville, is the first of a series of public camps scattered along or near the North Fork of the Yuba River. Frog Hollow is on Willow Creek which is not a tributary to the North Fork of the Yuba but runs into Bullards Bar reservoir to the west of Camptonville. These public camps lie in a naturalist's and fisherman's paradise and are likewise good base camps for the geologically minded. The 36 miles between Frog Hollow and Sierra City lies through excellent outcroppings of a

wide range of igneous and metamorphic rocks of great interest to petrologists and rock lovers of all kinds (49).

JOUBERT HYDRAULIC DIGGINS

In the vicinity of the Joubert hydraulic diggings, the highway crosses from Yuba to Sierra County. Sierra County is famous for the many large gold nuggets it has produced. One from the Monumental mine at Sierra Buttes weighed 1596 oz. troy, worth $17,654. The placers of French Ravine produced four nuggets which weighed from 93 to 532 oz. each. Henry G. Hanks in his compilation of famous gold nuggets published in 1882 lists no less than 13 Sierra county nuggets among the 83 largest produced in the world to that date. The Ruby mine, previously mentioned in connection with Alleghany, is still producing sizeable nuggets (49).

Highway 49 passes through the heart of the Joubert hydraulic diggings and the Eocene gravels and clays can be studied there at close range. The Joubert deposits contain a large percentage of white clay which would be valuable if it could be separated from admixed gravels. Some areas are of almost pure white clay. Other parts of the deposit have off-colored clays ranging from deep red to lavender. Clay deposits are present in association with many other Eocene gravel deposits of Nevada, Yuba, and Sierra Counties, but to date, the only clays of the Sierran foothills that are being worked are at the edge of the Sacramento Valley, principally in the vicinity of Ione, Amador County (49).

A splendid panorama up the V-shaped canyon of the Yuba may be seen 2.6 miles northeast of Joubert just before the highway descends to the level of the river. Youthful stream profiles may be seen at other points along the highway between Joubert and Downieville (49).

A thick series of partially metamorphosed volcanic rocks is exposed in the vicinity of the highway bridge over the North Fork of the Yuba. Amygdaloidal flows, agglomerates and tuffs may be seen in various stages of metamorphism some completely recrystallized to schist and others in the lavas along the dirt road leading off to the north of the bridge. Good parking places may be had along this road and exposures are good along the river and in places along the road (49).

INDIAN VALLEY CAMPGROUND

Indian Valley public camp, the second of a series of excellent camp site beside the river, is located two miles east of the bridge. Half a mile before reaching the camp is the granodiorite south of Camptonville. The belt of serpentine which appears on the map is not evident from the highway. The granodiorite intrusion is 1.7 miles wide along the highway. One miles west of Ramshorn Creek bridge is a good exposure of gray-green chert associated with

phyllite and meta-volcanics. Another public camp is located at the junction of Ramshorn Creek with the North Fork of the Yuba (49).

BALD TOP MOUNTAIN

Midway between Ramshorn Creek and Goodyears Bar, good views of the columnarly jointed basalt of Bald Top Mountain may be seen to the north. The Bald Top and adjacent lavas represent the latest period of Sierran volcanism with the possible exception of some flows ont the east side of the range (49).

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